



**U.S. AIR FORCE**

# **AAC Systems Engineering RFP Guide**

**Version 1.0**

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## APPROVAL PAGE

Use of the Air Armament Center (AAC) Systems Engineering Request for Proposal Guide is approved for AAC, Eglin Air Force Base, Florida.

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## TABLE OF CONTENTS

<b>1.0</b>	<b>RFP GUIDE OVERVIEW.....</b>	<b>5</b>
1.1	Background.....	5
1.2	Guide Employment .....	5
1.3	Content.....	6
1.4	Approach for AAC SE RFP Guide Updates.....	6
<b>2.0</b>	<b>SYSTEMS ENGINEERING MANAGEMENT PLAN .....</b>	<b>8</b>
2.1	Introduction .....	8
2.2	Section L.....	8
2.3	Section M.....	19
2.4	Statement of Objectives .....	31
2.5	DIDs.....	31
2.6	References .....	31
<b>3.0</b>	<b>INTEGRATED CHARACTERIZATION, MATURATION, AND VERIFICATION PLAN..</b>	<b>33</b>
3.1	Introduction .....	33
3.2	Section L.....	33
3.3	Section M.....	35
3.4	Statement of Objectives .....	37
3.5	DIDs.....	37
3.6	References .....	38
<b>4.0</b>	<b>RISK MANAGEMENT PLAN .....</b>	<b>39</b>
4.1	Introduction .....	39
4.2	Section L.....	39
4.3	Section M.....	41
4.4	Statement of Objectives .....	43
4.5	DIDs.....	44
4.6	References .....	46
<b>5.0</b>	<b>SUPPLY CHAIN MANAGEMENT PLAN .....</b>	<b>47</b>
5.1	Introduction .....	47
5.2	Section L.....	47
5.3	Section M.....	49
5.4	Statement of Objectives .....	51
5.5	DIDs.....	52
5.6	References .....	52
<b>6.0</b>	<b>SAFETY PROGRAM PLAN .....</b>	<b>53</b>
6.1	Introduction .....	53
6.2	Section L.....	53

6.3	Section M.....	56
6.4	Statement of Objectives .....	58
6.5	DIDs.....	60
6.6	References .....	62
<b>7.0</b>	<b>CONFIGURATION MANAGEMENT PLAN.....</b>	<b>64</b>
7.1	Introduction .....	64
7.2	Section L.....	64
7.3	Section M.....	65
7.4	Statement of Objectives .....	67
7.5	DIDs.....	67
7.6	References .....	68
<b>8.0</b>	<b>MANUFACTURING AND ASSEMBLY PLAN.....</b>	<b>69</b>
8.1	Introduction .....	69
8.2	Section L.....	69
8.3	Section M.....	71
8.4	Statement of Objectives .....	78
8.5	DIDs.....	82
8.6	References .....	82
<b>9.0</b>	<b>PROGRAM RELIABILITY PLAN.....</b>	<b>84</b>
9.1	Introduction.....	84
9.2	Section L.....	84
9.3	Section M.....	85
9.4	Statement of Objectives .....	87
9.5	DIDs.....	88
9.6	References .....	88
<b>10.0</b>	<b>ACRONYM LIST.....</b>	<b>89</b>

## LIST OF TABLES

<b>Table 1. NDIA RECOMMENDED PLANS .....</b>	<b>7</b>
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## **1.0 RFP GUIDE OVERVIEW**

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### **1.1 Background**

The Air Armament Center and its industry partners have made conscientious efforts to revitalize systems engineering (SE) during the last three years. As part of this effort, the National Defense Industry Association (NDIA) was asked to identify issues that impact industry's ability to institute good SE engineering practices into their programs. One of the major findings was that SE was considered part of the cost trade space, unless SE tasks were specifically called out in the contract. To remain competitive during the bidding process, companies have minimized or eliminated SE processes and practices to have viable business opportunities. To ensure adequate SE efforts are included in their programs, they recommended the government be more specific in its direction with respect to expected SE activities and products during the selection process. At the request of AAC/CA, NDIA also agreed to develop a model request for proposal (RFP) with recommended SE content and deliverables to be bid and placed on contract. This guide has been developed using their model RFP and includes language designed to encourage and enforce the use of robust SE processes and practices within industry. The focus is on activities supporting Systems Requirement Review (SRR) in the Technology Development Phase (Risk Reduction) through Engineering and Manufacturing Development (EMD). Program offices can tailor the language to accommodate other acquisition phases. Complementing this effort, MIL-HDBK-520 on preparation of the System Requirements Document (SRD), is currently being developed.

### **1.2 Guide Employment**

During the development of this guide, the intent of AAC/ENS was to document language that captured SE best practices and aligns with current DoD, AF, AFMC, and AAC policy and guidance, as well as statutes and federal regulations. While this language is recommended, both requirements and resources vary from program to program and tailoring within each RFP and contract is expected. However, many of the requirements do map directly to the organizational Systems Engineering Plan (SEP) and program office compliance with all "shall" statements in that SEP is mandatory. It is the responsibility of the program office to modify the requirements contained in this guide to complement their own internal SE processes and practices, and eliminate any duplication of effort between their office and the contractor. The guidance contained in this guide has also been reviewed by AAC directors of engineering, contracting, finance, and the judge advocate's office.

Throughout this guide, the reader will find notes formatted in “gray boxes” like this one. The language in these gray notes is not intended for inclusion in RFPs. Some gray notes provide guidance on the applicability of certain RFP paragraphs depending on the technology or program phase. Others are added to provide reference to other guidance documents or simply to provide the reader with information regarding the usefulness and reasons for the proposed RFP language.

### **1.3 Content**

The majority of the requirements contained in this guide can be satisfied by the delivery of a series of technical plans during the proposal process which capture the Offeror’s intended approach to meeting these requirements. (See Table 1 for a complete list of all NDIA recommended plans.) The content of each of these plans is described in the following chapters. In each chapter, following a brief introduction and overarching guidance for that particular plan, the recommended language for Section L (Instructions, Conditions and Notices to Bidders), Section M (Evaluation Factors and Rating Methodology), and Statement of Objectives (SOO) is presented. Though the wording is designed for these specific sections, it may be reorganized for another section, such as Section H, should this be more apropos for a given program or project. Though the plans are individually described, the delivery of individual documents is not necessarily required and the program office or contractor may combine the plans to align with internal needs or processes. This guide does not address the Logistics and Support Plan or the Small Business Consideration Plan. These plans complement the technical plans, but are developed by the logistics and contracting communities.

This guide contains a large number of potential Section L deliverables for an offeror’s proposal. The intent is not for wholesale inclusion of them by the program office, but to select key discriminators for the particular source selection at hand. The program office must keep in mind that all of the offerors’ deliverables must be reviewed and evaluated as part of source selection; and inclusion of non-discriminatory deliverables adds unnecessarily to the workload. It is highly recommended that prior to developing the RFP, the program office ensure that their participating engineering personnel take SE RFP training offered by AAC/ENS and that they consult with AAC/ENS early in the RFP development process for advice concerning use of content within this guide. Keep in mind that the delivery of formal plan documents, required for the execution of the program, may more appropriately be included in the contract as a SOO development task with a contract data requirements list (CDRL) item. The ultimate goal is to ensure adequate SE is conducted to minimize technical program risk and cost.

### **1.4 Approach for AAC SE RFP Guide Updates**

The AAC Engineering Directorate (EN) shall review the AAC SE RFP Guide annually to ensure that it complies with applicable policies and continues to contain the appropriate recommended SE RFP language for the AAC’s portfolio of programs. Any changes to the AAC SE RFP Guide

shall be vetted through the 308<sup>th</sup> Armament Systems Wing (ARSW) Group Directors of Engineering (DOEs), 308<sup>th</sup> ARSW Group Commanders/Directors (CCs/CLs), AAC/XR, AAC/FM, AAC/PK, AAC/JA, and 46<sup>th</sup> TW, and must be approved by AAC/EN, 308<sup>th</sup> ARSW, and the Air Force Program Executive Office for Weapons (AFPEO/WP).

**Table 1. NDIA Recommended Plans**

Title
1 - Systems Engineering Management Plan
2 - Integrated Characterization Maturation Verification Plan
3 - Risk Management Plan
4 - Supply Chain Management Plan
5 - Safety Program Plan
6 - Configuration Management Plan
7 - Manufacturing and Assembly Plan
8 - Program Reliability Plan
9 - Logistics and Support Plan
10 - Small Business Consideration Plan

## 2.0 SYSTEMS ENGINEERING MANAGEMENT PLAN

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### 2.1 Introduction

This chapter of the guide contains content to consider for developing a Systems Engineering Management Plan (SEMP) in RFPs. This chapter describes systems engineering activities required to address processes and procedures that should normally be accomplished as part of the Systems Development portion of any normal systems acquisition program. The following chapters address SE content that may be stand-alone documents or included in the SEM. Depending on the acquisition phase and the maturity of the program, information presented in support of the program proposal could be a slide show addressing the Offeror's plan and approach to addressing this information, institutional plans performed in support of a certification process or formal program plans developed in earlier phases. The information in the chapter is consistent with and captures the relevant requirements from the AAC Standard Systems Engineering Processes and Practices (SSEPP), AFMCI 63-1201, and the Air Force Systems Engineering Assessment Model (AF SEAM). This chapter has content that relates to all other chapters in this guide. Ensure changes are assessed against other chapters.

The SEM Data Item Description (DID) included at the end of this chapter should be modified to ensure all pertinent information required by the program is addressed in the SEM. The tailored SEM DID should be developed in parallel with the DIDs for the other required plans in this guide. In aggregate, the set of DIDs should completely spell out the SE information required by the program office.

### 2.2 Section L

The Offeror shall submit a SEM in a format consistent with the Offeror's internal procedures. The plan shall provide a complete and thorough description of the Offeror's proposed systems engineering process, with direct explanation of how the process will address meeting specific requirements in each section of the government's System Requirements Document (SRD), and shall, as a minimum, include the elements identified herein.

**2.2.1 Program Planning and Control.** The SEM shall identify the program organization, planning and monitoring activities proposed by the Offeror. The information provided is intended to show the details of the Offeror's product-oriented program structure and management approach to product development. Key elements of program planning and control include:

**2.2.1.1 Program Organization.** The program organization shall be structured to correlate directly to the product architecture and the program work breakdown structure (WBS), with integrated multi-disciplined teams allocated to key product elements (e.g., an Integrated Product Team (IPT)-type structure). The contractor's systems engineering function shall interface with



the government's Systems Engineering IPT (SEIT). The contractor's risk management function shall interface with the government's Risk Management IPT (RM IPT).

The SEIT and RM IPT are defined in the AAC Standard Systems Engineering Processes and Practices (SSEPP). MIL-STD-881 defines the program office's WBS requirements.

**2.2.1.2 Integrated Master Plan (IMP) and Integrated Master Schedule (IMS).** The Offeror's IMP shall be an event-driven plan that identifies key activities and critical program events for contracted activities. The plan shall also identify accomplishments and entry and exit criteria that will be tracked to assess the contractor's ability to meet the key events identified in the IMP. The IMP establishes the program's baseline. The IMS is the controlling program schedule document used by all IPTs to develop supporting schedules to implement program tasks. The IMP/IMS should be structured to support monitoring of all critical program activities and key supporting activities. A Level 4 IMP/IMS is recommended, but the level may be adjusted based on the complexity and risk associated with the program. Program critical path items shall be clearly identified in the IMS. The Offeror's SEMP shall be consistent with and support activities and timelines in the proposed IMP/IMS.

**2.2.1.3 Technical Performance Measures (TPM).** TPMs shall be used to monitor and assess the technical maturity of the product throughout its development cycle. The Offeror shall as a minimum identify the TPMs it intends to use to track technical performance, proactively identify potential technical problems and track the effectiveness of corrective actions and risk mitigations. The set of TPMs shall include metrics for each of the product's key performance parameters (KPPs), along with other important parameters as appropriate.

**2.2.1.4 Risk Management.** The Offeror shall propose a proactive risk management process targeting technical, cost, and schedule risks. The evidence shall be provided in the Risk Management Plan.

Accountability for systems engineering is critical to the success of an acquisition and control should be maintained via the IPT structure. In addition to the SEIT equivalent organization function referenced in 2.2.1.1, the contractor should propose any other IPT structures designating clear lines of authority, process for issue resolution, and required membership.

**2.2.1.5 Major Technical Reviews.** The Offeror shall propose a technical review process appropriate for all phases of the product development. Major technical reviews shall be identified, and included as milestones on the IMS. Technology Readiness Levels (TRLs) and Manufacturing Readiness Levels (MRLs) shall be assessed and presented, along with supporting data and analyses, at each major technical review. Major technical reviews shall have the following attributes, as appropriate for the phase and scope of the development activity:

**2.2.1.5.1** Timeliness of the review with respect to the activities to be reviewed as identified in the IMP/IMS.

**2.2.1.5.2** Clearly identified, and appropriate entry and exit criteria.

**2.2.1.5.3** A review panel comprised of the appropriate engineering and program disciplines to ensure a thorough detailed review.

**2.2.1.5.4** Detailed technical content appropriate for the phase and scope of the development activity at the time of the review (e.g., requirements, system architecture, analyses and trades, detailed designs, test results, design margin and design characterization status).

**2.2.1.5.5** An assessment of relevant risks, along with risk mitigation plans and status.

**2.2.1.5.6** A closed-loop process for addressing issues and actions from the review.

**2.2.1.5.7** A presentation of design margin analyses and testing, along with results of system characterization.

**2.2.1.6** The Offeror shall propose technical reviews required to manage the program activities and include in the IMP/IMS. The major technical reviews to be accomplished during the development activity include the following:

The program office and contractor should include the Operator/User and other government stakeholders in technical reviews. Ensure all entrance and exit criteria are linked to the technical and/or performance requirements of the contract. Entry and exit criteria shall address as a minimum those criteria identified for each technical review as listed in the AAC SSEPP, November 2008.

**2.2.1.6.1 System Requirements Review (SRR).** The SRR shall be a multi-disciplined technical review convened by the contractor for the formal review of the System Requirements and the contractor's system solution. The data presented in the review shall provide evidence that the contractor's system solution (including both hardware and software, as applicable) is consistent with the system requirements.

**2.2.1.6.2 Preliminary Design Review (PDR).** The PDR shall be a multi-disciplined technical review convened by the contractor, subsequent to the SRR and the decomposition of the system's functional definition, to determine whether the hardware and software preliminary designs are complete, and the program is ready to start detailed design.

**2.2.1.6.3 Critical Design Review (CDR).** The CDR shall be a multi-disciplined technical review convened by the contractor for the formal review of the product's detailed design. Completion of the CDR confirms that the design is ready for the commencement of formal system integration and weapon-level testing.

**2.2.1.6.4 Test Readiness Review (TRR).** The TRR is a multi-disciplined technical review convened by the contractor to assess the readiness of the system or its subsystems to proceed into formal testing (e.g., flight testing, qualification testing, sled testing, and other major test events).

**2.2.1.6.5 Functional Configuration Audit (FCA).** Following FQR-2, an FCA shall be conducted by the contractor to demonstrate sufficient testing and other required methods of verification have been accomplished to verify that the system's performance meets specification requirements. The Requirements Verification Matrix (RVM) is a key tool of the FCA process, and forms the basis for requirements verification. Customer participation in the FCA is expected.

**2.2.1.6.6 Physical Configuration Audit (PCA).** The PCA shall be conducted by the contractor, subsequent to the FCA, to verify that the hardware and software products generated from the contractor's manufacturing, assembly, inspection and test processes and evaluated during FCA are consistent with those defined in the technical data package (TDP).

**2.2.1.6.7 Production Readiness Review (PRR).** The PRR shall be a series of multi-disciplined reviews convened by the contractor to verify that the system requirements are fully met in the final production configuration.

**2.2.1.6.8 Other Technical Reviews.** Other technical reviews may be proposed as needed, depending on the scope of the program, and may include peer reviews, Technical Interchange Meetings (TIM), Interface Control Working Group (ICWG) meetings, etc.

If the program office determines that other technical reviews are required, they should be specifically cited in the RFP.

**2.2.1.7 Configuration Management.** The Offeror shall propose a configuration management process encompassing: internally generated and supplier generated documents; internally generated and supplier generated data; and shared interface documentation - as described in the document titled "Configuration Management Plan."

**2.2.1.8 Subcontractor Control.** The Offeror shall propose a subcontractor and supplier management process that minimizes cost, schedule and technical performance risks in acquisitions from lower-tier suppliers. The process shall be as described in the document titled "Supplier Chain Management Plan."

**2.2.1.9 System Safety Program Plan.** The Offeror shall submit a System Safety Program Plan (SSPP) in a format consistent with the Offeror's internal procedures that describes the methodologies to be employed on the program, using MIL-STD-882D and AFI 91-202. The System Safety Program Plan tasks and events shall be consistent with the IMP and IMS and are defined in the document titled "Program Safety Plan."

**2.2.1.10 Requirements Development, Tracking and Verification.** The Offeror shall propose a disciplined control process for the development of requirements for the product and its subcomponents. The process shall include methodologies for the decomposition of requirements provided by the customer into system requirements for the product, and shall include the development of a functional architecture for the system, based on the system requirements. Analyses, simulations and trade studies used in the requirements derivation

process shall be described in detail. System requirements shall be reviewed by the SEIT and program technical managers over the course of EMD verifying adequate design characterization margins and sensitivities. System requirements shall be documented and updated in a system performance specification.

**2.2.1.10.1** The Offeror shall propose a requirements traceability methodology that documents and retains details of the relationships between requirements at all levels, as well as the relationships between the requirements and the product's hardware and software implementations. The methodology shall be bi-directional, and a relational data base (e.g., Dynamic Object Oriented Requirements System (DOORS<sup>®</sup>) or a similar tool) shall be included in the methodology. The methodology proposed shall also support the identification of disconnects (or errors) in the bi-directional requirements flow, as well as sufficient data from underlying analyses to permit scrutiny of the analyses.

**2.2.1.10.2** The Offeror shall propose the methodology whereby system and lower-tier requirements will be verified. The full product verification plan shall be as defined in the Integrated Characterization/Maturation/Verification Plan.

**2.2.1.11 Hardware Design.** The Offeror shall propose an effective hardware design process that promotes affordability and lean initiatives at the start of the design cycle, and assures participation of all program functions in the development of a product design that is producible, reliable, supportable, affordable, and that meets the customer's operational and performance requirements, and life cycle and disposal needs. Design for Manufacturing (DFM) and Design for Assembly (DFA) processes shall be employed during the hardware design process. Key elements of the hardware design process include, but are not limited to, those described herein.

This guide does not contain material on life-cycle logistics and sustainment. For more information, refer to the AFMC Acquisition Sustainment Tool Kit (ASTK).

**2.2.1.11.1** Development of a physical system architecture directly traceable to the functional system architecture established during requirements development activities. The development process shall include appropriate trades that consider (as a minimum) performance requirements and performance margin, environmental conditions, interfaces, producibility, supportability, alternative technologies, make/buy options, customer biases and cost. The physical architecture shall be documented and the documentation maintained throughout the development process. The documentation shall show traceability of the physical configuration back to the system requirements.

**2.2.1.11.2** Development of design requirements shall be a key consideration for individual configuration items within the system physical architecture. The development process shall include appropriate trades that consider (as a minimum) performance requirements and performance margin, environmental conditions, interfaces, security, producibility, supportability, alternative technologies, make/buy options, and cost. The design requirements shall be documented, along with their underlying analyses and data, and maintained throughout the

development process. The configuration item designs shall be traceable directly to the configuration design requirements, which shall be traceable to the system requirements.

The Air Force directive Technology and Acquisition Systems Security Program Protection (AFPD 63-17) establishes that security is an equal partner in systems acquisition to cost, schedule, performance, and supportability. It applies to Acquisition Programs at all levels from project/program initiation through declaration of full operational capability, sustainment, and demilitarization. Security, Technology Protection and Counterintelligence assessment are elements to be considered by government team and conveyed as appropriate to contractors during pre-contract solicitation and throughout the conduct of the program.

Anti-Tamper (AT) measures are considered to protect Critical Program Information (CPI) and Critical System Resources (CSR). The analysis and recommendation to use or not to use anti-tamper measures are documented in a classified annex to the Program Protection Plan (PPP). Documentation such as an Anti-Tamper Plan is part of the PPP. <http://at.dod.mil>

Sample contract language to place PPP on contract:

“A Program Protection Plan (PPP) and supporting annexes will be provided as Government Furnished Information (GFI). The contractor will follow guidance in the PPP and annexes for protection of Critical Program Information (CPI) identified in the PPP. The contractor will, as requested by the government, provide input to updates of the PPP and associated annexes. Any modifications or deviations to the PPP or annexes will be made in writing by the program contracting officer. Requests for clarification of the PPP or annexes will be made by the contractor to the contracting officer not later than thirty (30) days from receipt of the PPP, its annexes, or updates thereof.”

**NOTE:** PPPs are NOT part of the National Industrial Security Program Operating Manual and need to be added on the DD Form 254.

**2.2.1.11.3** The Offeror shall describe the use of models and simulations in the development of hardware and software designs and verification of system and subsystem performance. Models and simulations shall be used in support of system trades, electrical circuit analysis, mechanical design analyses, airframe aerodynamics analysis, system flight performance assessment, and other design and verification activities as appropriate. Modeling and Simulations shall also be used throughout the program lifecycle for system support, training, mission planning, etc.

**2.2.1.11.4** Design Margin shall be a key consideration during the design process and throughout the weapon lifecycle. The margin analyses shall consider the impacts of supplier design changes to Commercial-Off-The-Shelf (COTS) components, and shall accommodate them to the maximum extent practical. Methodologies employing parametric variation (such as Design of Experiments) shall be used as appropriate during the design process.

**2.2.1.11.5** Document the designs of the system and its configuration items, and maintain the design documentation, including all design change activity, in accordance with the Configuration Management Plan.

**2.2.1.11.6** Definition and documentation of test plans for the verification of the function and performance of the configuration items shall be as described in the Integrated Characterization Maturation Verification Plan.

**2.2.1.11.7** A review process shall be proposed. Reviews for the hardware design activity shall include, but are not limited to the reviews identified in paragraph 2.2.1.5. The internal reviews are led by the contractor, and government participation in the review process is both allowed and encouraged.

**2.2.1.11.8** The EMD hardware fabrication, integration, and test results shall be a key consideration. To the extent practical, EMD hardware shall be manufactured and assembled using production processes and tooling. A clearly defined path for providing feedback based on test and integration results into the original design shall be provided as described in the Configuration Management Plan.

**2.2.1.11.9** The Offeror shall characterize the Hardware design. The hardware design shall be fully characterized through appropriate analysis, modeling, simulation and test. The characterization shall account for all applicable environments and intended usages, and shall verify that the expected performance margin exists within the design and manufacture/assembly allowable process variations. Methodologies employing parametric variation (such as Design of Experiments) shall be used as appropriate to maximize the efficiency of the characterization process and the test program in its totality. The hardware design characterization activities shall culminate in the testing of production-like hardware to ensure that the production design meets all expectations for performance and performance margin.

**2.2.1.11.10** If COTS components are considered for use in the design, the design process shall evaluate the variability and configuration of the COTS parts to the extent practical and ensure that sufficient design margin exists to allow the expected variation without impacting the hardware's ability to meet its specification requirements.

**2.2.1.12 Software Design.** The Offeror shall propose a software development process that encompasses all phases of software development, from software requirements development through verification and validation and maintenance of the software product. The process shall include a methodology for configuration management and change control, a software quality activity that is integral to the development process, a risk management process that incorporates software risks into the program risk management process, a software organization that is reflective of the software product structure and review process. Major software milestones shall be included in the program IMP and IMS. Key elements of the Offeror's proposed software development process shall include, but are not limited to:

**2.2.1.12.1 Development of Software Design Requirements.** A documented process shall be employed for the development of software design requirements. The design requirements shall be directly traceable to the system performance requirements. Methodologies used shall be identified and shall include analyses, trade studies and simulations as appropriate for the level of complexity and risk associated with the product. The software requirements shall be documented and placed under configuration control for reference throughout the development program. Additionally:

**2.2.1.12.1.1** Major software requirements development milestones shall be incorporated into the program IMP/IMS.

**2.2.1.12.1.2** Requirements for the software development environment and software test environment shall be defined or referenced.

**2.2.1.12.1.3** Reviews (formal and internal) shall be accomplished during the requirements development process. This shall include a Software Specification Review (SSR) and Peer Reviews of analyses, trade studies, and simulations.

**2.2.1.12.1.4** Applicable test levels (e.g., unit, component, software configuration item, system) shall be identified for the requirements, along with the verification methodologies, and these shall be documented in a software test plan.

**2.2.1.12.1.5** Military standards invoked or used as references shall be cited.

**2.2.1.12.2 Software Design Methodology.** The Offeror shall propose the methodology whereby top-level design options are evaluated in establishing the product's software architecture design. Analyses, trade studies and simulations are applicable to this activity. Some, but not all, of the parameters pertinent to the evaluation are: performance, testability, use of COTS, maintainability, reuse, and safety. Additionally:

**2.2.1.12.2.1** A methodology shall be proposed that provides for bi-directional traceability of the system requirements through the software work products applicable to each phase of the development activity.

**2.2.1.12.2.2** Software design risks shall be identified and tracked in accordance with the risk management plan described in Risk Management Plan.

**2.2.1.12.2.3** The Offeror shall describe how software architecture will be reviewed during system technical reviews, including the PDR, CDR, and Initial Technical Review (ITR). Entry and exit criteria allowing assessment of software readiness for each review shall be defined.

**2.2.1.12.2.4** The software architecture shall be placed under configuration control described in the Configuration Management Plan.

**2.2.1.12.2.5** Customer furnished equipment, including software, services, documentation, and facilities, required in order to execute the software design activity (and subsequent software activities) shall be identified.

**2.2.1.12.2.6** Major software design milestones shall be incorporated into the program IMP/IMS.

**2.2.1.12.2.7** The software detailed design shall be developed consistent with the architecture and placed under configuration control. Key attributes of the detailed design include:

**2.2.1.12.2.7.1** The design is traceable to the requirements.

**2.2.1.12.2.7.2** The design can be implemented.

**2.2.1.12.2.7.3** Reuse is utilized where practical.

**2.2.1.12.2.7.4** Interfaces are defined, including operating system, hardware, software and graphical-user interfaces.

**2.2.1.12.2.7.5** The design is testable.

**2.2.1.12.2.8 Software Code and Unit Test.** The Offeror shall propose a controlled process for the development of software code and unit test. Tools used in the software development process shall be defined, along with configuration control tools and methodologies. The source code developed shall be consistent with and traceable to the detailed design. The process shall include peer reviews during the code development process. Unit test cases shall be developed, and the results of the unit tests shall be documented. The final source code configuration, including modifications made during the unit test process, shall be placed under configuration control. A software test plan reflective of the controlled source code configuration shall be developed and also placed under configuration control.

**2.2.1.12.2.9 Software Configuration Item Build, Integration and Test.** The Offeror shall propose a methodology for the build, integration, and test of software configuration items. Traceability to the software design architecture shall be evident in the process. Faults found during integration shall be identified, tracked, and appropriate corrective actions developed and tested. Testing shall verify that all requirements associated with the configuration items are met, and that appropriate corrective actions shall be taken as needed. All test results shall be documented and linked to the configuration tested, and the final tested configuration shall be placed under configuration control.

**2.2.1.12.2.10 Formal Software Testing.** The Offeror's software development process shall include the formal testing of the product's software. Results of the testing shall be documented, and shall be traceable back to the configuration tested. A Version Description Document shall be created and placed under configuration control. The configuration control methodology shall allow for the implementation of necessary changes and shall document all change activity, along with the resultant new (modified) configurations and their test results.

**2.2.1.12.2.11 Software Delivery, Transition, and Maintenance.** The Offeror shall propose a process for the delivery, transition and maintenance of the product's software. The process shall ensure that:



**2.2.1.12.2.11.1** A methodology is defined for the preparation of executable software and applicable source files, and the installation of the software into its target environment.

**2.2.1.12.2.11.2** Change control is appropriately implemented and needed changes can be implemented in a controlled and traceable manner after the software is delivered.

**2.2.1.12.2.11.3** A methodology for regression testing is defined that minimizes the risk posed by software changes to the as-delivered configuration.

**2.2.1.12.2.11.4** User Manuals are prepared and provided as applicable.

**2.2.1.12.2.12 Support Software.** The Offeror shall propose a methodology for the development and control of all support software to be used during the product's hardware and software development and production activities. As a minimum, the requirements associated with the support software shall be documented, and the support software shall be placed under configuration control, with changes to the software appropriately documented.

**2.2.1.12.2.13 Software Supplier Technical Monitoring.** The Offeror shall propose a process for the monitoring of technical activities of external software suppliers. The process shall include:

**2.2.1.12.2.13.1** Flow down of software requirements to the supplier is traceable to the system requirements, specifically define the requirements for the procured product, and clearly define all applicable hardware, software and data interfaces associated with the product.

**2.2.1.12.2.13.2** The identification of planned review milestones for the supplier's software development activities. Metrics shall be identified and implemented that allow regular, effective assessment of the product's technical, schedule, and cost status.

**2.2.1.12.2.13.3** The methodology for review and approval of software deliverables. (This may include, but is not limited to, technical and programmatic reviews, documentation reviews and testing.)

**2.2.1.12.2.13.4** The input of the configuration of the supplier's delivered software into the Offeror's configuration management system. The supplier's software configuration shall be controlled and updated appropriately when change activity occurs.

**2.2.1.12.2.13.5** A closed-loop approach for identifying supplier software development issues and tracking the corrective actions to completion.

**2.2.1.12.2.14 Software Safety.** The Offeror shall propose a process that integrates software safety development process with the systems safety program plan. The following shall be included or integrated in the SSPP:

**2.2.1.12.2.14.1** The approach for the identification of software safety risks through safety analyses.

**2.2.1.12.2.14.2** The criteria to be used in assigning the hazard criticality of a software function based on the associated software safety risk.

**2.2.1.12.2.14.3** Mitigation/Minimization of software safety risks by analysis of the software safety critical requirements, implementation in design and code, and subsequent testing.

**2.2.1.12.2.14.4** Assessment of program changes for their impact to software safety analysis and functions.

**2.2.1.12.2.14.5** A means of recording the results of software safety analyses.

**2.2.1.13 Product Characterization/Maturation/Verification.** The Offeror shall propose a detailed product maturation plan that defines the path from the product's initial design through the development and verification of its final configuration. The plan shall include all phases of testing involved in the product development process, including testing directed at establishing sufficient design margin to account for hardware variability throughout the life of the product. The product maturation process is defined in the chapter on the Integrated Characterization/Maturation/Verification Plan.

**2.2.1.14 Reliability, Supportability, and Logistics.** The Offeror shall propose a methodology for establishing and maturing the reliability and supportability of the product from inception through fielding. This methodology is defined in the following paragraphs of this document.

**2.2.1.14.1 Logistics and Supportability Plan.** The Offeror shall provide a logistics and support plan that defines how the Offeror shall meet the logistics requirements of the program.

The Logistics and Supportability Plan is not included in this guide. This requirement should be discussed and tailored with logistics personnel in the AAC Acquisition Excellence (ACE) office.

**2.2.1.14.2 Program Reliability Plan.** The Offeror shall propose a program reliability plan that defines how the Offeror will meet the reliability requirements of the program. The plan shall detail the time-phased activities necessary at all levels of the supply chain to model, grow and maintain the required reliability as well as activities necessary to demonstrate the required reliability has been achieved.

**2.2.1.14.3 Manufacturing and Assembly Process.** The Offeror shall propose a manufacturing and assembly process that is fully integrated into product development activities as described in the Manufacturing and Assembly Plan.

The program office should consider tasking the Offeror to support independent technical peer reviews such as those identified in AAC/CC Memo; Subject: Acquisition Changes to Improve Reliability, Manufacturing, and Safety.

## **2.3 Section M**

The Offeror's proposed Systems Engineering Management Plan will be evaluated based on the description, adequacy, and applicability of the proposed systems engineering process and cost-effective quality of the resulting proposed technical program content and controls. Specific items to be evaluated are as described herein.

**2.3.1 Program Planning and Control.** The Offeror's proposed program planning will be evaluated based on the adequacy and cost effectiveness of the proposed technical program to deliver a product that meets the performance based specification requirements with the required reliability, within program schedule constraints. Adequacy of planning will be evaluated based upon the Offeror's consistent application of technical plan approaches across all organizations participating in the program and the resulting resource adequacy to successfully execute the plan. Further, the planning will be evaluated upon program content, its allocation to IPTs, and traceability to the WBS. The control methodology will be evaluated for the effectiveness of its structure to collect the necessary information to make informed decisions on any changes to the plans. Elements of the control process to be evaluated include: the effective use of milestone planning and monitoring; use of technical performance measures; a proactive risk management process; a thorough review process; a configuration management process; a supplier and subcontractor management process; and a plan for management of system safety throughout the life of the program. Attributes to be assessed for these activities are described herein.

**2.3.1.1 Program Organization.** The Offeror's proposed program organization will be evaluated for the effective use of IPTs. The IPT structure should be product oriented, and reflect the integration of subcontract and supplier contributions. The IPTs should be aligned with the WBS structure and traceable to the activities within the IMS. The organizational structure should show the contractor's identified IPT that is the primary technical interface between all IPTs, as the coordinator of all technical activities and as the conduit by which requirements flow to all IPTs. The contractor's proposed IPT should include technical management and responsible representatives from other program functions and IPTs. The IPT shall interface with the customer SEIT IPT.

**2.3.1.2 Integrated Master Plan (IMP) and Integrated Master Schedule (IMS).** The Offeror's IMP and IMS will be evaluated to ensure that the IMP, IMS, WBS, SOW and Earned Value Management System (EVMS) are clearly linked, and that key program events are clearly identified in both the IMP and IMS, and are appropriately time phased in the IMS. The IMS will be evaluated for its completeness, and the inclusion of key event milestones for all IPTs. The IMS activities should be clearly traceable to the various responsible IPTs, and to any associated technical plans. Activities within the IMS should also be coded so that if the activity is

subcontracted, the responsible subcontractor is identified. The IMS should depict the use of each Asset Utilization Matrix entry [as defined in paragraph 3.2.5.2 and DID DI-MISC-81283] and should clearly show the critical path activities for the program. The IMS risk assessment will also be evaluated for realism.

**2.3.1.3 Technical Performance Measures (TPMs).** The Offeror's proposed TPMs will be evaluated for their ability to provide a complete and technically appropriate assessment of the technical maturity of the system design. The TPMs shall include program KPPs, and should be linked to other system performance requirements (requiring special management) as well.

**2.3.1.4 Risk Management.** The Offeror's proposed Risk Management Plan will be evaluated as defined in Risk Management Plan chapter of this document.

**2.3.1.5 Technical Reviews.** The Offeror's proposed technical review process will be evaluated for the appropriate use of technical reviews throughout the life of the program. Key reviews identified in Section L, Systems Engineering Management Plan, should be included and identified in the program IMP and IMS. Technology Readiness Levels (TRL) and Manufacturing Readiness Levels (MRL) should be assessed and presented, along with supporting data and analyses, at each major technical review. General characteristics on which all technical reviews are evaluated include the following:

**2.3.1.5.1** The review should be conducted at or near the completion of the activities to be reviewed, and at or near the start of the next program activities (or phase) to be entered.

**2.3.1.5.2** Entry and exit criteria are clearly identified and are appropriate for the type of review to be conducted.

**2.3.1.5.3** Disciplines of the review panel are identified and are comprised of the appropriate engineering and program disciplines to ensure a thorough, detailed review of the technical material to be presented.

**2.3.1.5.4** Detailed technical content is identified and is appropriate for the phase and scope of the development activity at the time of the review (e.g., requirements, system architecture, analyses and trades, detailed designs, test results, design margin, and design characterization status).

**2.3.1.5.5** A detailed risk assessment is included along with risk mitigation plans and status.

**2.3.1.5.6** A closed-loop process for addressing issues and actions from the review is identified.

**2.3.1.5.7** Status of design margin analyses and testing, along with results of system characterization, should be presented at each technical review.

**2.3.1.6** Specific characteristics to be evaluated for the major technical reviews, in addition to the general characteristics described above, include:

Technical reviews shall be event-driven and not schedule driven clearly identifying entrance/exit criteria and to what WBS level. Responsibilities at each technical review shall be clearly identified and the Offeror shall describe who the stakeholders are and how they will be involved.

**2.3.1.6.1 Systems Requirements Review (SRR).** The technical material presented in the SRR should provide evidence that the contractor's system solution (including both hardware and software, as applicable) is consistent with the system requirements and clearly shows that the program is ready to begin preliminary hardware and software design. Specific characteristics of an SRR-ready design, on which the Offeror's proposal will be assessed, include:

**2.3.1.6.1.1** Selected technologies have demonstrated the capability to provide required performance within the environments defined by the service use profile—within the laboratory environment at a minimum.

**2.3.1.6.1.2** Preliminary design (point of departure) is complete with attendant integrated verification and maturation planning complete (includes asset utilization matrix).

**2.3.1.6.1.3** Requirements mapping to the preliminary design is complete.

**2.3.1.6.1.4** Failure tree analyses and MIL-STD-1629A Failure Modes and Effects Criticality Analysis (FMECA)/Single Point Failure (SPF) analysis are in-work.

**2.3.1.6.1.5** Weapon external interfaces are defined (mechanical, logical, electrical, etc.).

**2.3.1.6.1.6** Built-in-Test (BIT) strategy is defined; Acceptance Test Plan (ATP) strategy is defined; and test hierarchy and tolerance funneling are defined.

**2.3.1.6.1.7** Manufacturing has the capability to produce the system—component or item in a laboratory environment.

**2.3.1.6.1.8** Current assessed TRLs and MRLs.

**2.3.1.6.2 Preliminary Design Review (PDR).** The technical material presented at the PDR should demonstrate that the decomposition of the system's functional definition is complete, the preliminary hardware and software designs are complete, and the program is ready to start detailed design. Specific characteristics of a PDR-ready design on which the Offeror's proposal will be assessed include:

**2.3.1.6.2.1** Service use environments have been measured.

**2.3.1.6.2.2** System architecture trade studies complete.

**2.3.1.6.2.3** Subsystem design characterization is complete and includes identification of any margins.

**2.3.1.6.2.4** Performance analysis is consistent with requirements.

**2.3.1.6.2.5** Wind tunnel testing and database construction are complete.

**2.3.1.6.2.6** Mapping of requirements to design is complete (includes external interfaces).

**2.3.1.6.2.7** MIL-STD-1629A FMECA/Single Point Criticality Analysis (SPCA) is complete to the Subsystem (Line Replaceable Units) level.

**2.3.1.6.2.8** BIT is defined.

**2.3.1.6.2.9** Manufacturing has capability to produce the system, component or item in a production-representative environment.

**2.3.1.6.2.10** Current assessed TRLs and MRLs.

**2.3.1.6.3 Critical Design Review (CDR).** Evidence provided in the CDR shall show that sufficient analysis, modeling, and testing of a production-like design have been accomplished to ensure that system integration and weapon-level testing may be accomplished with a low risk of significant findings. Completion of the CDR confirms that the design is ready for the commencement of formal system integration and weapon-level testing. Specific characteristics of the CDR-ready design on which the Offeror's proposal will be assessed include:

**2.3.1.6.3.1** Design is fully characterized and expected performance sensitivities are understood.

**2.3.1.6.3.2** Mapping of design to requirements is complete.

**2.3.1.6.3.3** Performance correlations to simulation are complete.

**2.3.1.6.3.4** Configuration definition is mature, including critical manufacturing, assembly, and inspection processes and controls.

**2.3.1.6.3.5** Contractor Developmental Test (DT) weapon flight test has been completed.

**2.3.1.6.3.6** Discrete changes necessary in EMD are defined and evaluated for impact.

**2.3.1.6.3.7** ATP is complete.

**2.3.1.6.3.8** Tech orders are ready for verification and validation.

**2.3.1.6.3.9** Design is sufficiently stable to enter into low rate initial production.

**2.3.1.6.3.10** Critical Manufacturing Process Controls are identified.

**2.3.1.6.3.11** Current assessed TRLs and MRLs.

**2.3.1.6.4 Test Readiness Reviews (TRR).** The TRR considers the readiness of the system or its subsystems to proceed into formal testing (e.g., flight testing, qualification testing, sled testing and other major test events).

**2.3.1.6.5 Functional Configuration Audit (FCA).** The FCA considers evidence that system, subsystem and supplier performance meet specification requirements. The RVM should be used as a key tool of the FCA process, and forms the basis for requirements verification. Customer participation in the FCA is expected. (See Configuration Management Plan)

**2.3.1.6.6 Physical Configuration Audit (PCA).** The material presented at the PCA should verify that the hardware and software products generated from the contractors' and suppliers' manufacturing, assembly, inspection and test processes and evaluated during FCA are consistent with those defined in the technical data package (TDP). (See Configuration Management Plan)

**2.3.1.6.7 Production Readiness Review (PRR).** The PRR considers evidence that the system requirements are fully met in the final production configuration, and that production capability fully supports entering Low-Rate Initial Production (LRIP) and Full-Rate Production, including:

**2.3.1.6.7.1** Production readiness is at its highest level.

**2.3.1.6.7.2** Stable Design Configuration is implemented.

**2.3.1.6.7.3** System, component or item is in production or has been produced meeting all engineering, performance, quality and reliability requirements.

**2.3.1.6.7.4** All materials—manufacturing processes and procedures, inspection, and test equipment—are controlled in production to 6-sigma or other appropriate quality level.

**2.3.1.6.7.5** The product is proven, affordable, and able to meet the required schedule.

**2.3.1.6.8 Other Technical Reviews.** The Offeror's proposal will also be evaluated on its use of other technical reviews as appropriate for the scope and complexity of the program. These may include Peer Reviews, Technical Interchange Meetings (TIM), Interface Control Working Group meetings (ICWG), and others.

**2.3.1.7 Configuration Management.** The Offeror's proposed Configuration Management Process will be evaluated as defined in the chapter of this document on Configuration Management Plan.

**2.3.1.8 Subcontractor Control.** The Offeror's proposed Supplier and Subcontract Control Process will be evaluated as defined in the chapter of this document on Supply Chain Management Plan. Insight into the subcontractor's processes is a key element.

**2.3.1.9 System Safety.** The Offeror's proposed System Safety Program Plan (SSPP) will be evaluated as defined in the chapter of this document on Program Safety Plan.

**2.3.1.10 Requirements Development, Tracking, and Verification.** The Offeror's Requirements Development, Tracking, and Verification Process will be evaluated for appropriate execution of activities throughout the development program. Key elements of the process include:

**2.3.1.10.1** A clearly defined, effective analytical process for the derivation of system requirements from mission requirements, and for the decomposition of those requirements to

derived lower-tier requirements. The process must include appropriate technical reviews of those analyses, and provide for retention and retrieval of those analyses throughout the life of the program. A clearly defined, effective methodology for trade studies that weighs cost, producibility, maintainability, and other factors against performance to achieve the best overall solution. Cost should be treated as an independent variable (CAIV) in the trade studies. Establish a System Performance Specification. The use of simulations and modeling during the requirements development and verification processes to ensure a robust design and a low-risk entry into operational testing. The simulations chosen are appropriate for the type of product being developed, and parametric variation methodologies (such as Monte Carlo analyses) are to be used to the maximum extent practical to evaluate system design margin. Where appropriate, the use of 6-degrees of freedom models and hardware-in-the-loop simulations is strongly encouraged.

**2.3.1.10.2** Establish and document a system functional architecture traceable directly to the system requirements. The use of appropriate tools to provide documentation, retention and bi-directional traceability of the product's requirements from the top-level system requirements to the lower-tier requirements applicable to subsystems and assemblies. The methodology should allow identification of disconnects within the requirements flow paths. A relational database tool (e.g., DOORS® or a similar tool) is recommended for this activity. Applications of appropriate analytical techniques are to be used in the requirements development process. Examples of techniques include, but are not limited to, the use of Schematic Block Diagrams, Functional Flow Diagrams, Data Flow Diagrams, Timeline Analyses, and State/Mode Diagrams. Identify key hardware characteristics or features and their application to the design, verification and manufacturing processes. The key hardware characteristics or features are to be documented and retained for use during the life of the program, and evaluated for impact when hardware design changes are being developed. Failure Modes and Effects Analyses (FMEA) and fault tree analyses are to be incorporated into the requirements development and design process early and are used and updated throughout the design activity. Current results are presented at system technical reviews, such as PDR, and CDR. Establish a Requirements Verification Matrix that will serve as the defining document for requirements verification at all levels of testing and analysis during the development program. Verification testing and analysis is described in Integrated Characterization, Maturation and Verification Plan.

**2.3.1.11 Hardware Design.** The Offeror's SEMP will be evaluated for an effective hardware design activity that provides a Point-of-Departure design that meets the required TRL and MRL levels; promotes affordability and lean initiatives at the start of the design cycle; and assures participation of all program functions in the development of a product design that is producible, reliable, supportable, affordable; and meets the customer's operational and performance requirements. Key elements of the hardware design process to be evaluated include:

**2.3.1.11.1** A physical system architecture directly traceable to the functional system architecture established during requirements development activities. The physical architecture should be documented and the documentation maintained throughout the development process.



The documentation must show traceability of the physical configuration back to the system requirements. Appropriate trade studies applied to the development of the physical system architecture and subsystem configuration items that consider (as a minimum) performance requirements and performance margin, environmental conditions, internal and external interfaces, producibility, manufacture and assembly process variability, reliability, supportability, alternative technologies, make/buy options, cost and risk.

**2.3.1.11.2** Definition of design requirements for individual configuration items within the system physical architecture. The design requirements should be documented and maintained throughout the development process. The configuration item designs must be traceable directly to the configuration item design requirements, which must in turn be traceable to the system requirements.

**2.3.1.11.3** Effective use of models and simulations in the development of system and configuration item designs and design verification. Models and simulations should be used in support of system trades, electrical circuit analysis, mechanical design analyses, airframe aerodynamics analysis, system flight performance assessment, and other design and verification activities as appropriate.

**2.3.1.11.4** Appropriate analyses, models and simulations shall be utilized to develop sufficient performance margin in the system, subsystems and modular components, including potential variations and critical manufacturing and assembly processes to ensure a highly reliable design that design poses a low risk of failure to meet specified performance throughout the product's life cycle. Effective use of physical models and prototypes to assist in identifying and reducing risks by investigating available and emerging technologies; verifying that the design solution meets allocated functional, performance, and interface requirements and constraints; and verifying that the design solution satisfies the functional architecture and requirements baseline.

**2.3.1.11.5** A hardware design concept that will meet functional, performance, margin, cost and other requirements, as flowed down from the system design process. Baseline hardware requirements are allocated to the applicable design components, and preliminary designs are developed and reviewed. The documentation of all designs, and the maintenance of that documentation, including all design change activity, should be executed in accordance with Configuration Management Plan.

**2.3.1.11.6** Definition and documentation of test requirements and test plans for the verification of the function and performance of the configuration items, as described in the Integrated Characterization Maturation and Verification Plan (ICMVP).

**2.3.1.11.7** A thorough and effective review process. All government required reviews must be addressed. Internal reviews should support the government reviews and provides adequate government insight into program execution.

**2.3.1.11.8** Effective use of prototype hardware for integration and test, in support of an iterative design process. To the extent practical, prototype hardware should be fabricated and tested at both the configuration item level and the system level. Integration with the customer's using equipment is also highly desired during the development process. A clearly defined path for

design iteration that provides feedback based on test and integration results into the original design should be included as described in Configuration Management Plan. Effective DFA and DFM methodologies in the hardware design process should be included.

**2.3.1.11.9** Inclusion of effective methodologies and plans for the establishment of appropriate margin in the hardware design. Parametric variation methodologies (e.g., design of experiments) are used to the maximum extent practical. Full product characterization is accomplished using production-like hardware and software. PFMECA, FMECA and fault tree analyses are accomplished for the product.

**2.3.1.11.10** The Offeror will ensure that if COTS items are used in the design that such items have known margins, and an effective process for mitigating the impact of vendor changes in COTS parts to design performance and margin exists. Appropriate performance of COTS items shall be validated to the requirements and traced via the Requirements Verification Matrix. An example of performance validation for a COTS item may be via test and analysis, with some acceptance testing to confirm margin maintenance.

**2.3.1.12 Software Design.** The Offeror's proposal will be evaluated for an effective Software development process.

**2.3.1.12.1 Development of Software Design Requirements.** Design Process that encompasses all phases of software development, from software requirements development through verification and validation and maintenance of the software product. Key elements of the software design process to be evaluated include the following:

**2.3.1.12.1.1** An effective configuration management and change control methodology. Tracking of major software events as milestones in the program IMP/IMS. Software quality is integrated into the software development process. Software risks are incorporated into the program risk management activity.

**2.3.1.12.1.2** Requirements for the software development environment and software test environment are defined or referenced. The software organizational structure is reflective of the software product structure and is integral to the program organization.

**2.3.1.12.1.3** The Offeror makes appropriate use of formal, internal (peer) and program status reviews throughout the software development process. The Offeror has an effective and documented process for the development of software design requirements. Key considerations include:

**2.3.1.12.1.3.1** The design requirements are directly traceable to the system performance requirements.

**2.3.1.12.1.3.2** Trade studies and simulations are employed as appropriate for the level of complexity and risk associated with the product.

**2.3.1.12.1.3.3** The software requirements are documented and placed under configuration control.

**2.3.1.12.1.4** Applicable test levels (e.g., unit, component, software configuration item, system) are identified for the requirements, along with the verification methodologies, and these are documented in a software test plan.

**2.3.1.12.1.5** Military standards invoked or used as references are cited.

**2.3.1.12.2 Software Design Methodology.** An effective and documented process is used for the design of the product's software architecture. Appropriate use is made of analyses, trade studies and simulations. Some, but not all, pertinent parameters to be considered are: performance, testability, use of COTS, maintainability, reuse and safety. Key considerations include:

**2.3.1.12.2.1** Bi-directional traceability is provided for the flow from system requirements through software work products, as applicable to each phase of the development activity.

**2.3.1.12.2.2** Software design risks are identified and tracked in accordance with the risk management plan described in the Risk Management Plan.

**2.3.1.12.2.3** The software architecture is reviewed during system technical reviews, including the PDR and CDR. Entry and exit criteria allowing assessment of software readiness for each review are defined. Customer participation in the formal reviews is allowed and encouraged.

**2.3.1.12.2.4** The software architecture is placed under configuration control.

**2.3.1.12.2.5** Customer furnished equipment including software, services, documentation, and facilities required in order to execute the software design activity (and subsequent software activities) are identified.

**2.3.1.12.2.6** The Offeror will incorporate major software design milestones into the program's IMP/IMS.

**2.3.1.12.2.7** The software detailed design is consistent with the software architecture and is placed under Configuration control. Key attributes of the detailed design include:

**2.3.1.12.2.7.1** The design is traceable to the requirements.

**2.3.1.12.2.7.2** The design can be implemented.

**2.3.1.12.2.7.3** Reuse is implemented where practical.

**2.3.1.12.2.7.4** Interfaces are defined, including operating system, hardware, software and graphical-user interfaces.

**2.3.1.12.2.7.5** The design is testable.

**2.3.1.12.2.8 Software Code and Unit Test.** An effective process for the development of software code and unit test. Key considerations include:

**2.3.1.12.2.8.1** Tools used in the software development process are defined, along with configuration control tools and methodologies.

**2.3.1.12.2.8.2** The source code developed is consistent with and traceable to the detailed design.

**2.3.1.12.2.8.3** The process includes appropriate use of peer reviews during the code development process.

**2.3.1.12.2.8.4** Unit test cases are developed, and the results of the unit tests are documented.

**2.3.1.12.2.8.5** The final source code configuration, including modifications made during the unit test process, is placed under configuration control.

**2.3.1.12.2.8.6** A software test plan reflective of the controlled source code configuration is developed and placed under configuration control.

**2.3.1.12.2.9 Software Configuration Item Build, Integration and Test.** An effective process for the build, integration and test of software configuration items. Key considerations include:

**2.3.1.12.2.9.1** The configuration design is traceability to the software design architecture.

**2.3.1.12.2.9.2** Faults found during integration are identified, tracked, and appropriate corrective actions developed and tested. Any “Can Not Duplicate” type faults must be recorded and reviewed at each design review for possible reoccurrence.

**2.3.1.12.2.9.3** Testing verifies that all requirements associated with the configuration items are met, and appropriate corrective actions are taken as needed.

**2.3.1.12.2.9.4** All test results are documented and linked to the configuration tested, and the final tested configuration is placed under configuration control.

**2.3.1.12.2.10 Formal Software Testing.** A process that includes formal testing of the product’s software. Key considerations include:

**2.3.1.12.2.10.1** Test results are documented, and are traceable to the configuration tested.

**2.3.1.12.2.10.2** A Version Description Document is created and placed under configuration control. The configuration control methodology allows for the implementation of necessary changes and documents all change activity, along with the resultant new (modified) configurations and their test results.

**2.3.1.12.2.11 Software Delivery, Transition, and Maintenance.** An effective process for the delivery, transition, and maintenance of the product's software. Key considerations include:

**2.3.1.12.2.11.1** An effective methodology is defined for the preparation of executable software and applicable source files, and the installation of the software into its target environment.

**2.3.1.12.2.11.2** Change control is appropriately implemented, and needed changes can be implemented in a controlled and traceable manner after the software is delivered.

**2.3.1.12.2.11.3** An effective methodology for regression testing is defined that minimizes the risk posed by software changes to the as-delivered configuration.

**2.3.1.12.2.11.4** User Manuals are prepared and provided as applicable.

**2.3.1.12.2.12 Support Software.** An effective methodology for the development and control of all support software to be used during the product's hardware and software development activities. Key considerations include:

**2.3.1.12.2.12.1** As a minimum, the requirements associated with the support software are documented.

**2.3.1.12.2.12.2** The support software is placed under configuration control, with changes to the software appropriately documented.

**2.3.1.12.2.13 Software Supplier Technical Monitoring.** An effective process for monitoring the technical activities of external software suppliers. Key considerations include:

**2.3.1.12.2.13.1** Flow down of software requirements to the supplier is traceable to the system requirements, specifically define the requirements for the procured product, and clearly define all applicable hardware, software, and data interfaces associated with the product.

**2.3.1.12.2.13.2** Planned and appropriate milestones for the supplier's software development activities are documented in the program's IMS.

**2.3.1.12.2.13.3** Appropriate metrics are identified and implemented that allow regular, effective assessment of the product's technical, schedule, and cost status.

**2.3.1.12.2.13.4** An appropriate process for the review and approval of supplier's software deliverables is identified. This may include, but is not limited to, technical and programmatic reviews, documentation reviews, and testing. Software Quality Engineering is integral to the review and approval process to assess the supplier's compliance with their software plans and processes.

**2.3.1.12.2.13.5** The configuration of the supplier's delivered software is input into the Offeror's configuration management system. The supplier's software configuration is controlled and updated appropriately when change activity occurs.

**2.3.1.12.2.13.6** A closed-loop approach for identifying supplier software development issues and tracking the corrective actions to completion is defined.

**2.3.1.12.2.14 Software Safety.** Software controlling safety critical functions shall address potential software safety risks and any safety critical software shall be identified in the Systems Safety Program Plan per Chapter 6 of this document. Key considerations are:

**2.3.1.12.2.14.1** Software safety risks are identified through safety analyses.

**2.3.1.12.2.14.2** The criteria to be used in assigning the hazard criticality of a software function based on the associated software safety risk are identified and be consistent with the SSPP.

**2.3.1.12.2.14.3** The plans are identified for analysis of the software safety critical requirements, their implementation in design and code, and their subsequent testing to ensure that software safety risks are mitigated or minimized.

**2.3.1.12.2.14.4** Program changes are assessed for their impact to software safety analysis and functions.

**2.3.1.12.2.14.5** Software safety analyses are documented.

**2.3.1.13 Product Characterization/Maturation/Verification.** The Offeror's proposed Product Maturation Process will be evaluated as defined in the chapter on Integrated Characterization, Maturation and Verification Plan.

**2.3.1.14 Reliability, Supportability, and Logistics.** The Offeror's proposed Product Support Process content will be evaluated as defined in the chapters on Logistics and Supportability Plan (to be developed later), the Program Reliability Plan, and the Manufacturing and Assembly Plan.

**2.3.1.14.1 Logistics and Supportability Plan.** The Offeror's proposed Product Support Process content will be evaluated as defined in the chapter on Logistics and Supportability Plan.

The Logistics and Supportability Plan is not included in this guide. These requirements should be discussed and tailored with logistics personnel in the AAC ACE.

**2.3.1.14.2 Program Reliability Plan.** The Offeror's proposed reliability process content will be evaluated as defined in the chapter on Program Reliability Plan.

**2.3.1.14.3 Manufacturing and Assembly Process.** The Offeror's proposed manufacturing and assembly process content will be evaluated as defined in the chapter on Manufacturing and Assembly Plan.

The Offeror shall ensure during the design phase that, at a minimum, the areas of the AAC SSEPP paragraph 3.2.3 are addressed and all corrective actions for design weaknesses and process defects are accomplished prior to Production Readiness Review.

## **2.4 Statement of Objectives**

The contractor shall develop, maintain, and document a systems engineering approach. The approach shall address program requirements, technical staffing and organization planning, technical baseline management, technical review planning, and integration with overall management of the program. The contractor shall implement this approach to ensure a well-documented technical foundation for the program.

## **2.5 DIDs**

<a href="#"><u>DI-IPSC-81431A/T</u></a>	<a href="#"><u>System Performance Specification</u></a>
<a href="#"><u>DI-MGMT-81739</u></a>	<a href="#"><u>Software Resources Data Reporting: Initial Developer Report and Data Dictionary</u></a>
<a href="#"><u>DI-MGMT-81740</u></a>	<a href="#"><u>Software Resources Data Reporting: Final Developer Report and Data Dictionary</u></a>
<a href="#"><u>DI-SESS-81785</u></a>	<a href="#"><u>System Engineering Management Plan (SEMP)</u></a>
<a href="#"><u>DI-IPSC-81433A/T</u></a>	<a href="#"><u>Software Requirement Specification (SRS)</u></a>
<a href="#"><u>DI-ADMN-81250A/T</u></a>	<a href="#"><u>Conference Minutes</u></a>
<a href="#"><u>DI-ILSS-81495</u></a>	<a href="#"><u>Failure Mode Effects and Criticality Analysis Report</u></a>

## **2.6 References**

AFMCI 63-1201 – Implementing Operational Safety Suitability and Effectiveness (OSS&E) and Life Cycle Systems Engineering (LCSE)

<http://www.e-publishing.af.mil/shared/media/epubs/AFMCI63-1201.pdf>

AF SEAM – Air Force Systems Engineering Assessment Model (Releasability restrictions unknown. Contact Air Force Center for Systems Engineering, WPAFB, OH 45433)

AAC Standard Systems Engineering Processes and Practices (SSEPP) (Distribution D. Contact AAC/EN, Eglin AFB, FL 32542)

DoDD 5200.39, Critical Program Information (CPI) Protection Within the Department of Defense, 16 July 2008

<http://www.dtic.mil/whs/directives/corres/pdf/520039p.pdf>

AFPD 63-17, Technology and Acquisition Systems Security Program Protection, 26 November 2001 (Distribution F. Contact HQ USAF/XOFI)

Air Force Pamphlet 63-1701, Program Protection Planning, 27 March 2003 (Distribution F. Contact HQ USAF/XOFI)

AFI 91-202 – The US Air Force Mishap Prevention Program

<http://www.e-publishing.af.mil/shared/media/epubs/AFI91-202.pdf>

Military Standard 881B – Military Standard: Work Breakdown Structures for Defense Materiel  
[MIL-STD-881b \(Notice 1\), Military Standard: Work Breakdown Structures For Defense Materiel Items \(2 Jan 1998\) \[S/S BY MIL-HDK-881\]](#)

Military Standard 882D – Standard Practice for System Safety

[http://www.everyspec.com/MIL-STD/MIL-STD+\(0800+--+0899\)/MIL STD 882D 934/](http://www.everyspec.com/MIL-STD/MIL-STD+(0800+--+0899)/MIL STD 882D 934/)

Air Force Acquisition Sustainment Tool Kit (ASTK), ASTK Community of Practice (Releasability restrictions unknown. Contact HQ AFMC/A4UA)

AFI 99-103 Capabilities-Based T&E

<http://www.af.mil/shared/media/epubs/AFI99-103.pdf>

AFMCI 99-103 Test Management (Distribution F. Contact HQ AFMC/DOF, WPAFB, OH)

AFMAN 63-119 Certification of System Readiness for Dedicated Operational T&E

<http://www.e-publishing.af.mil/shared/media/epubs/AFMAN63-119.pdf>



## **3.0 INTEGRATED CHARACTERIZATION, MATURATION, AND VERIFICATION PLAN**

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### **3.1 Introduction**

This guide chapter contains content to consider for integrated characterization, maturation, and verification (C/M/V) activities in RFPs. This chapter describes related activities required at the system/subsystem/component levels from Technology Development Phase (Risk Reduction) through Engineering and Manufacturing Development (EMD) for system integration and performance verification. The information in the chapter is consistent with and captures the relevant requirements from the AAC SSEPP, AFMCI 63-1201 and the AF SEAM. This chapter has content that relates to content in the Systems Engineering Management Plan chapter and the Configuration Management chapter. Ensure changes are assessed against these related chapters.

### **3.2 Section L**

The Offeror shall propose a detailed Integrated Characterization, Maturation, and Verification Plan (ICMVP) in a format consistent with the Offeror's internal procedures to sufficiently describe the C/M/V processes to be employed on the program. Design characterization activity first assesses the sensitivity of the various levels of the design to the combined effects of operational environment exposure with manufacture and assembly process variations. With the sensitivities of the design understood, characterization analysis and test activity defines the related performance margins of the design, when affected by the combination of environmental exposure and worst cases manufacture and assembly process variation. Maturation activity is test and analysis activity that develops assurance that the characterized design will meet the operational use requirements, and may resemble highly accelerated life testing. Verification is the activity to show compliance of a system/subsystem/component with its specification via inspection, basis of similarity, demonstration, analysis, modeling and simulation and/or test. A system/subsystem is considered mature when it is fully characterized, verified, and under configuration control. The ICMV Plan does not define required margins, but rather identifies the characteristic margins of a product, and ensures that those margins are sufficient and maintainable. The characterization activity should identify any design sensitivity to manufacturing or assembly practices and thereby define acceptable process control limits to achieve product performance margin. These activities are also expected to identify critical characteristics or key features of the design. The Offeror's ICMVP proposal shall define how the TRL and MRL are integrated into the entry and exit criteria of program technical reviews as well as intermediate reviews to include the full characterization of the design. The ICMVP should detail the time phased activities necessary to characterize, mature, and verify performance. During the Risk Reduction phase, C/M/V will be an iterative process to assess the viability of concepts and technologies, and mature the same. This process begins with preliminary system requirements and the Offeror's point of departure design (expected to be at TRL/MRL 4 at Milestone A) and shall result in a System Performance Specification and the Offeror's fully characterized Product Baseline Record by CDR. Post CDR activities will focus on system level

integration, qualification, performance verification, and cost effective production. Elements to be addressed in the ICMVP include but are not limited to:

**3.2.1** Describe the strategy and activities to show compliance with the program specification requirements. The Offeror's approach should describe how the technical strategy results in a cost effective developmental approach, and ensures high probability of meeting product Average Unit Production Cost (AUPC) goals.

**3.2.2** Describe the strategy and activities to ensure the system, subsystems, and components have sufficient design margins, meet the desired TRLs and MRLs, and comply with all program specification requirements. The process flow shall define C/M/V requirements and objectives and group them into C/M/V events which generate the data required to show design margins, maturity, and compliance. Include supporting the generation of the Life-cycle Signatures Support Plan (LSSP) when needed.

**3.2.3** Define the required resources, assets, schedules, facilities, special equipment, skilled personnel, analytical tools, simulated and/or real interfaced systems, etc., required to implement the program C/M/V events.

**3.2.4** Describe the analysis used to ensure the ICMVP captures sufficient test data to provide confidence that the system will function across operational scenarios and throughout the complete operational envelope.

**3.2.5** The offeror shall ensure that elements of the system design that are designed or produced under subcontract are subject to the tenants of the ICMV Plan. Provide Offeror and Supplier Data Products and Supporting Plans required for program C/M/V events including those listed below. If any of these data products cannot be completely developed at the time of proposal, then provide the partially-developed data product and evidence of a plan/process to fully develop the data product.

In some instances, a program is required to develop and manage a correlation matrix to capture critical aspects of the program that may be government controlled, such as Mission Planning or Weapon engineering requirements. These will not be covered by the Offeror's plans.

**3.2.5.1** A characterization matrix that captures system/subsystem/component design margins with the analysis and test data that supports the margin definition.

**3.2.5.2** A program inclusive asset utilization matrix to identify test assets and their intended use for each C/M/V event, including subcontracted items. The offeror shall subject this asset utilization matrix (to include all suppliers) to configuration management discipline throughout the period of the contract.

**3.2.5.3** A requirements verification matrix that captures system/subsystem/component performance and supporting test data, analysis, or basis of similarity argument for each

requirement specified and proves that performance meets or exceeds the specification requirement.

**3.2.5.4** A technical data package that includes: system/subsystem design and characterization/maturation data, and a data accession list to provide the government's access to appropriate program documentation. Data products shall identify COTS components.

**3.2.6** Roles and Responsibilities of organizations required to support implementation of the C/M/V processes.

### **3.3 Section M**

The Offeror's proposed activities to characterize, mature, and verify the system performance will be evaluated for adequacy and cost/schedule effectiveness. Particular attention will be given to the adequacy of the plan at each indenture of the system architecture, to the sufficiency of the resources proposed to conduct the activities, and the statistical approaches used to define a cost effective approach for analysis and test. Elements to be evaluated in the ICMVP include:

**3.3.1** The Offeror's C/M/V Approach will be evaluated on the thoroughness and cost effectiveness of the activities leading to a low risk entry to EMD. It is expected that an approach that provides a measure of statistical power and confidence for Key Performance Parameters and other critical technical performance measures be used to determine the overall C/M/V approach, to include the number of test assets required.

**3.3.2** The Offeror's C/M/V process will be evaluated on its sufficiency in determining design margins, meeting TRL and MRL requirements, and verifying system/subsystem performance to specification requirements. The process must ensure that each specification requirement is verifiable and the method(s) for verifying each requirement must be identified. Methods of verification may include inspection, demonstration, analysis, modeling and simulation, and/or test. Where modeling and simulation are used to verify system level performance, the process shall include sufficient demonstration and test to adequately verify and validate the models themselves. The adequacy of the process will also be based on the method for identifying and resolving anomalies, problem reporting, and re-verification that occurs. The Offeror will be evaluated on the ability to support the LSSP required for each milestone.

**3.3.3** The Offeror's ICMVP will be evaluated based on the adequacy and efficiency of the proposed resources, assets, schedules, facilities, special equipment, skilled personnel, etc., to implement the program C/M/V events. The plan shall include the following if applicable: test tools and other equipment; software versions; modeling and simulation resources; simulated and/or real interfaced systems (e.g., aircraft platform); customer, contractor, third-party or associate contractor facilities; government furnished equipment; supplier involvement; special needs (e.g., security approved facilities, etc.).

**3.3.4** The Offeror's ICMVP will be evaluated based on the adequacy of the analysis to ensure the ICMVP captures sufficient test data to provide confidence that the system will function in an operational environment. Specifically, the analysis must account for test events representing required operational scenarios and the complete operational envelope.

**3.3.5** The Offeror's and supplier's C/M/V data products and supporting plans (for those data products not yet fully developed) will be evaluated based on the following:

**3.3.5.1** The characterization matrix should include the type of test to be performed (specification verification/margin or design sensitivity) and the system/subsystem/component under test. The matrix should include a full description of required test asset configurations that illustrate that the characterization activities are to be conducted on production configuration hardware and software. The matrix should also contain anticipated spares.

**3.3.5.2** The asset utilization matrix will be evaluated on its comprehensiveness and efficiency to include all C/M/V activities. The matrix should be "3-dimensional" describing the system/subsystem/component under test, the test type, and the number of units and configuration of each. The evaluation will also consider how the Offeror will cost effectively minimize the number of first-time capability test events at the system level.

**3.3.5.3** The requirements verification matrix will be evaluated on comprehensiveness and efficiency including the requirement to be evaluated, the method of verification, the performance/margin, and the hardware and software configuration associated with the analysis or test.

**3.3.5.4** The technical data package will be evaluated on comprehensiveness, timeliness to support knowledge-based milestones and identification of COTS components in all data products.

MIL-STD-31000 discusses Technical Data Packages and references 9 related DIDs.

**3.3.6** The Offeror's description of the C/M/V Roles and Responsibilities will be evaluated based on the defined teams' ability to perform the activities necessary to execute the ICMVP. The roles and responsibilities of customer, Offeror, and supplier teams shall be defined. The roles and responsibilities of these teams, as they relate to the C/M/V effort, shall be defined and maintained in their applicable Responsibilities, Accountabilities, and Authorities consistent with the program SEMP. The teams have the responsibility to support the development and implementation of C/M/V products, tasks, and events in order to show design margins, maturity, and compliance to specification requirements. Teams may include an Integration Working Group and a Test Working Group.

### 3.4 Statement of Objectives

The contractor shall develop and maintain a detailed Integrated Characterization, Maturation, and Verification Plan (ICMVP) to describe the Characterization/Maturation/Verification (C/M/V) processes to be employed on the program. The ICMVP shall define how the TRL and MRL are integrated into the entry and exit criteria for program technical reviews, as well as intermediate reviews, to include the full characterization of the design. The contractor shall perform an analysis to determine a cost effective structured approach to optimize the C/M/V effort and required test assets. The contractor shall ensure the ICMVP captures sufficient test data to provide confidence that the system will function across operational scenarios and throughout the complete operational envelope. The contractor shall develop and maintain Data Products and Supporting Plans required for program C/M/V events including a characterization matrix, an asset utilization matrix, a requirements verification matrix, and a technical data package. The contractor shall also require these Data Products and Supporting Plans from suppliers.

### 3.5 DIDs

[DI-MGMT-81453/T](#) [Data Accession List](#)

[DI-ADMN-81373/T](#) [Presentation Material](#)

[DI-NDTI-80566/80603/T](#) [Test Plan/Procedure](#)

[DI-CMAN-81248](#) [Interface Control Document](#)

[DI-NDTI-81284](#) [Test and Evaluation Program Plan](#)

Rename Test and Evaluation Program Plan to Integrated Characterization/Maturation/Verification Plan (ICMVP) to reflect the increased scope of including testing to characterize and mature the contractor's design.

[DI-IPSC-81431A/T](#) [System Performance Specification](#)

[DI-MISC-81283](#) [Specification Requirement Verification Matrix](#)

Tailor DI-MISC-81283 for applicability to the Characterization Matrix and Asset Utilization Matrix.

[DI-SESS-81785](#) [System Engineering Management Plan \(SEMP\)](#)

[DI-IPSC-81433A/T](#) [Software Requirement Specification \(SRS\)](#)

[DI-ADMN-81250A/T](#) [Meeting Minutes and Action Items](#)

### 3.6 References

AFMCI 63-1201 – Implementing Operational Safety Suitability and Effectiveness (OSS&E) and Life Cycle Systems Engineering (LCSE)

<http://www.e-publishing.af.mil/shared/media/epubs/AFMCI63-1201.pdf>

AF SEAM – Air Force Systems Engineering Assessment Model (Releasability restrictions unknown. Contact Air Force Center for Systems Engineering, WPAFB, OH 45433)

MIL-STD-31000 – Technical Data Packages

[https://assist.daps.dla.mil/quicksearch/basic\\_profile.cfm?ident\\_number=276980](https://assist.daps.dla.mil/quicksearch/basic_profile.cfm?ident_number=276980)

## **4.0 RISK MANAGEMENT PLAN**

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### **4.1 Introduction**

This chapter contains content to consider for risk management in RFPs. The emphasis is in understanding the technical risks associated with the proposed design, focus on their root causes, and their impact on the program. The information in this chapter is consistent with and captures the relevant requirements from the AAC SSEPP, AFMCI 63-1201, and the AF SEAM. With regards to technical risk, a recognized best practice in this area is the Risk Identification, Integration & Ilities (RI3) Guidebook; refer to Chapter 12, AFPAM 63-128 for further guidance. Technical risk is a core systems engineering process as such the program office should ensure consistency of requirements among the Systems Engineering Management Plan (e.g., WBS, IMP/IMS, EVM, etc.) and the Risk Management Plan chapters.

Consider incentivizing Risk Management (AFI 63-101). AF acquisition activities shall implement contract strategies, applying incentives where appropriate, to consistently motivate excellent contract performance while ensuring cost, schedule, and technical performance control. Refer to Chapter 7, AFPAM 63-128 and Federal Acquisition Regulation Part 16, as supplemented, for guidance on contract incentives.

### **4.2 Section L**

The Offeror shall propose a detailed Risk Management Plan (RMP) consistent with his internal procedures to sufficiently describe the risks associated with the proposed design solution and overall program execution throughout the life cycle of the program. The proposal must demonstrate the Offeror's ability to execute a timely, effective, and efficient Risk Management Plan. The proposal must demonstrate the Offeror's ability to conduct risk management in a systematic, disciplined manner concurrent with the engineering development effort and throughout the program's life cycle. Also, the Offeror's risk management approach must demonstrate the ability to focus management attention and resources, facilitate transmittal of sound information to decision makers at all levels of the organization, provide for government insight, and provide for metrics used to track/monitor completion of risk mitigation actions. The RMP shall include details of, but not be limited to, the following:

**4.2.1** Describe the risk management process, including risk identification, analysis, mitigation planning, mitigation plan implementation, and tracking to be used throughout the life cycle of the program.

As a minimum, risk analysis decomposition should be performed down to the 3<sup>rd</sup> Work Breakdown Structure (WBS) level (major subsystem) and identified risk issues explored down to the next lower levels of the WBS until it is not practical to continue. Technical risk may be decomposed using risk breakdown structure (e.g., requirements, technology maturity, design, integration, etc.).

**4.2.2** Describe the process for incorporating potential risk-driven impacts into proposal price, life cycle cost, and schedule.

Ensure Offeror's proposed cost and schedule thresholds and related criteria are consistent with latest DoD guidance/policy (e.g., values for Acquisition Program Baseline (APB) cost breach). Additional guidance on risk management can be found in the DoD Risk Management Guide for DoD Acquisition.

**4.2.3** Describe how the risk management process interfaces with the systems engineering, program management, and cost estimating/control processes.

**4.2.4** Describe the risk identification process, analysis and prioritization methodologies, and depth and scope of risk analysis. Provide detail on what specific risk analysis tools, practices, and methodologies will be used to define and assess risks. Identify all moderate and high risk items and technical performance measure parameters used to assess and monitor progress toward the elimination or control of identified risks.

**4.2.5** Describe the risk handling approach, including the option selection process for risk assumption, avoidance, control, or transfer. Include how to provide for government insight when implementing risk handling/mitigation actions for moderate and high risk items.

**4.2.6** Describe how resources are allocated and prioritized to mitigate moderate and high risks. Include relevant metrics used for risk monitoring and how this information will be fed back to the risk assessment and handling activities.

**4.2.7** Explain your approach to identifying and establishing acceptable risk levels to be achieved for transitioning to the next program phase.

**4.2.8** Summarize the extent to which the risk management process outlined in the Technical and/or Management Proposal have been successfully used on other programs or any other relevant experience.

**4.2.9** Describe the strategy for implementing, tracking, and monitoring risk management practices throughout the supply chain.

**4.2.10** Describe how risk management boards and related technical reviews will be constructed to identify and report risk items and how the application of risk management processes will be integrated with design characterization, maturity, and integration activities.



**4.2.11** Describe the use of management databases to maintain risk identification, mitigation status, and monitor related risk mitigation action items. Describe how accessible risk information is to decision makers at all levels of the organization including supply chain.

For automated risk tools/databases, use the Offeror's internal systems/products or commercial-off-the-shelf (COTS) software/databases to the maximum extent possible.

**4.2.12** The Offeror shall describe, as a minimum, the top ten (10) risks and describe mitigation strategies for each, using the above Section L criteria. Include a communication approach for government monitoring. Each Critical Technology Element (CTE) must be specifically addressed.

Though system engineering focuses on the risk management processes, the identification of risks offers the ability to assess the overall quality of their processes and the offeror's ability to perform it. This requirement elicits programs examples. The specific number requested should ensure a sufficient sample to adequately assess their methodology. Use this opportunity to evaluate the other criteria while in action and note the offeror's adeptness in performing it.

Based on the government's internal Risk Management assessment, select which area of risk that the Offeror should focus on; e.g., technical, schedule, cost. Be aware that in doing so, this will communicate which is of importance to the government.

### **4.3 Section M**

The proposal(s) will be evaluated to determine the Offeror's ability to conduct an effective, systematic, disciplined, and comprehensive risk management program and the ability to meet and comply with the Statement of Objectives (SOO)/Statement of Work (SOW) requirements. The evaluation considers the Offeror's ability and thoroughness to identify risk areas down to their root cause as well as the effectiveness of risk analysis and risk mitigation methodologies. The government will evaluate the extent of the Offeror's ability to perform risk assessment considering cost, schedule, and performance that is appropriate and suitable for the specific design and technical management approach. The government will evaluate the extent of the Offeror's ability to formulate timely, effective, efficient risk handling approaches to include prioritization and resource allocation. Elements to be evaluated in the risk management area include the following:

**4.3.1** The Offeror's proposal will be evaluated on the adequacy and efficiency of the risk management process, including risk identification, analysis, mitigation planning, mitigation plan implementation, and tracking to be used throughout the life cycle of the program. The Offeror shall propose a detailed Risk Management Plan (RMP) that contains these elements. The Offeror's risk analysis decomposition using Work Breakdown Structure (WBS) levels down to a practical level will be assessed.

**4.3.2** The Offeror's proposal will be evaluated on the adequacy and efficiency of the process for incorporating potential risk-driven impacts into proposal price, life cycle cost, and schedule. The government will evaluate that the Offeror's proposed cost and schedule thresholds and related criteria are consistent with latest DoD guidance/policy.

**4.3.3** The Offeror's proposal will be evaluated on the adequacy of how the risk management process interfaces with the systems engineering, program management, and cost estimating/control processes.

**4.3.4** The proposal will be evaluated on the thoroughness of the risk identification process, analysis and prioritization methodologies, and depth and scope of risk analysis. The detail on what specific risk analysis tools, practices, and methodologies will be used to define and assess risks will be evaluated. The evaluation will include the Offeror's process for identifying all moderate and high risk items. The evaluation will also include how technical performance measure parameters are used to assess and monitor progress toward the elimination or control of identified risks.

**4.3.5** The Offeror's proposal will be evaluated on the adequacy of the risk handling approach, including the option selection process for risk assumption, avoidance, control, or transfer. The evaluation will assess the Offeror's ability to identify risk areas down to its root cause as well as the effectiveness of risk analysis and risk mitigation methodologies. The government will assess how the Offeror plans to provide for government insight when implementing risk handling/mitigation actions for moderate and high risk items. Evaluation of the proposal will include the Offeror's level of conformance to established DoD risk management practices.

**4.3.6** The Offeror's proposal will be evaluated on the adequacy of how resources are allocated and prioritized to mitigate moderate and high risks. The evaluation will assess how relevant metrics used for risk monitoring are regularly generated and how this information is fed back to the risk assessment and handling activities.

**4.3.7** The Offeror's proposal will be evaluated on the adequacy of the approach to identifying and establishing acceptable risk levels to be achieved for transitioning to the next program phase.

**4.3.8** The proposal will be evaluated on the adequacy of the extent to which the risk management process outlined in the Technical and/or Management Proposal have been successfully used on other programs. Any other relevant experience will be evaluated.

**4.3.9** The Offeror's proposal will be evaluated on the adequacy of the strategy for implementing, tracking, and monitoring risk management practices throughout the supply chain.

**4.3.10** The Offeror's proposal will be evaluated on the adequacy of how risk management boards, related technical reviews, stake holder interfaces will be constructed to identify and

report risk items and how the application of risk management processes will be integrated with design characterization, maturity, and integration activities.

**4.3.11** The Offeror's proposal will be evaluated on the adequacy of the use of management databases to maintain risk identification, mitigation status, and monitor related risk mitigation action items. The evaluation will include how accessible risk information is to decision makers at all levels of the organization to include the supply chain.

**4.3.12** The Offeror's proposal will be evaluated on the thoroughness of the description of the mitigation strategies for each identified risk. Each Critical Technology Element (CTE) must be specifically addressed. The government will evaluate the extent the Offeror's proposed risk mitigation "burn down" plans for the identified risks are supported by metrics to enable monitoring of the "burn down" progress. A communication approach for government monitoring should be included.

#### **4.4 Statement of Objectives**

Implement a comprehensive risk management process that is focused on program risk areas and the program's critical path(s) to systematically identify and mitigate cost, schedule, and technical risks. Ensure contractor risk management processes are compatible with the government risk management process and provides for timely government insight.

If a SOW is used, consider the following:

a. The contractor shall establish and implement a Risk Management (RM) process integrated into the program management and systems engineering processes to enable successful completion of the program within stated technical performance objectives, schedule, and cost. Processes to be employed must achieve early identification and assessment, selection and pro-active implementation of risk control/handling strategies, and active monitoring and accessibility to status information. The processes must facilitate decision making at all levels of the organization to include the supply chain and facilitate reporting of the status of moderate and high risks to the government.

b. The contractor shall employ risk rating factors and metrics to assess the sufficiency of design characterization (design maturity, integration and manufacturing/production), program resource sufficiency to support design characterization and the adequacy of design characterization of leveraged technologies.

c. The contractor shall integrate risk handling and risk monitoring procedures with the program's IMS and IMP, Earned Value Management (EVM), and other risk reduction tools/processes.

d. The contractor shall track and monitor identified risks and brief status at key program milestones and major technical reviews. The contractor risk register must

emphasize continuous identification, analyzing, scoring, handling, monitoring, and controlling risks.

#### **4.5 DIDs**

At this time, there is no dedicated Data Item Description (DID) that sets the format and content for a (contractor) Risk Management Plan. Use existing or projected management/technical DIDs and tailor as required based on program needs. As an example, suggest using the following “generic management” DID and tailoring it per comment block.

[DI-MGMT-80004A/T Management Plan](#)

DRAFT

To transform a generic management plan into a risk management plan, modify the DID as follows:

1. Replace all occurrences of "Management Plan" with "Risk Management Plan"
2. Delete paragraphs 3.3, 3.6 and 3.7 of DID
3. Replace paragraph 3.2 of DID with the following:

Risk Management Plan shall cover and describe:

- a. The contractor's risk management approach, related internal resources, procedures and process that will be used to ensure critical risks impacting scope, schedule, budget, technical development and performance are proactively identified, analyzed/assessed, communicated, mitigated in an effective timely manner.
- b. How risk management is integrated concurrently into the contractor's systems engineering and program management processes including flow down to vendor/supply chain.
- c. How risk management is implemented into the contractor's program review process to include major technical reviews and how is presented to the customer.
- d. Risk management ground rules and assumptions used for risk analysis and assessments.
- e. Described the organization, charter, and implementation of Risk Management Boards as well as use of independent risk reviews.
- f. Methodology, analysis, and tools used in risk identification, evaluation and assessment. This paragraph shall detail how risks associated with the design, development, integration, and test and evaluation requirements are managed and track to completion.
- g. Risk tracking databases or forms used in documenting risk identification, analysis, prioritization, handling and monitoring activities.
- h. The contractor's periodic risk assessment report(s) that includes:
  - (1) Results of the comprehensive risk assessment,
  - (2) Risk handling plans for all risks judged to be moderate and high,
  - (3) Corresponding risk metrics for those risk items,
  - (4) Progress against risk mitigation plans and results to date in resolving those risks, and
  - (5) Minutes from risk management reviews.
- i. Interface to Integrated Baseline Reviews, cost, schedule, and other risk related tools (e.g., IMP/IMS, EVM, etc.).
- j. Approach to identifying and establishing acceptable risk levels to be achieved for transitioning to the next program phase.

## 4.6 References

Military Standard 882D – Standard Practice for System Safety

[http://www.everyspec.com/MIL-STD/MIL-STD+\(0800+--+0899\)/MIL STD 882D 934/](http://www.everyspec.com/MIL-STD/MIL-STD+(0800+--+0899)/MIL STD 882D 934/)

AFI 63-101 – Acquisition and Sustainment Life Cycle Management

<http://www.e-publishing.af.mil/shared/media/epubs/AFI63-101.pdf>

AFMCI 63-1201 – Implementing Operational Safety Suitability and Effectiveness (OSS&E) and Life Cycle System Engineering (LCSE)

<http://www.e-publishing.af.mil/shared/media/epubs/AFMCI63-1201.pdf>

AFPAM 63-128 – Guide to Acquisition and Sustainment Life Cycle Management

<http://www.e-publishing.af.mil/shared/media/epubs/AFPAM63-128.pdf>

AF SEAM – Air Force Systems Engineering Assessment Model (Releasability restrictions unknown. Contact Air Force Center for Systems Engineering, WPAFB, OH 45433)

Risk Identification Integration & Ilities (RI3) Guidebook

<http://www.afit.edu/cse/page.cfm?page=164&sub=110>

AAC Standard Systems Engineering Processes and Practices (SSEPP) (Distribution D. Contact AAC/EN, Eglin AFB, FL 32542)

Risk Management Guide for DoD Acquisition, 6<sup>th</sup> Ed., v1.0, Aug 06 (Releasability restrictions unknown. Contact OUSD(AT&L) Systems and Software Engineering, Enterprise Development (OUSD(AT&L) SSE/ED))

## **5.0 SUPPLY CHAIN MANAGEMENT PLAN**

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### **5.1 Introduction**

This chapter contains content to consider for manufacturing readiness and production planning. The information in the chapter is consistent with and captures the relevant requirements and guidance from the AAC SSEPP, AFMCI 63-1201, AF SEAM, AFI 63-501, AFMCI 63-501, AAC/CC Memorandum, and the DoD MRA/MRL Deskbook. The Department of Defense and Air Force acquisition policy and guidance specifies the use of Manufacturing Readiness Levels (MRLs) as a means of consistently and quantitatively measuring the manufacturing maturity and risk during a program's acquisition life cycle. This and other (i.e., Quality Assurance, Configuration Management, and Reliability) processes and requirements are to be "flowed down" from the prime contractor to all key suppliers. This chapter has content that relates to content in the Systems Engineering Management Plan chapter, the Manufacturing and Production chapter, and the Integrated Characterization, Maturation, Verification chapters; therefore, ensure modification of content derived from this chapter is consistent with those related chapters

### **5.2 Section L**

The Offeror shall propose a Supply Chain Management Plan (SCMP) in a format consistent with his internal procedures in sufficient detail to describe the proposed Supplier Programs and how their respective activity will be managed. The plan should include, but not be limited to, the following elements for each subcontracted item, appropriate to the program acquisition phase:

**5.2.1** A detailed description of the Offeror's make-buy decision process, including considerations for impacts on cost, schedule and performance.

**5.2.1.1** A detailed description of the subsystem or component proposed for subcontract procurement.

**5.2.1.2** An assessment of the percentages of new development and reuse, including the rationale for those proposed assessments. This should contain any relevant information on claims of existing product characterized maturity.

Applicability of the requirements in subparagraphs of 5.2.1 is dependent upon system maturity and should only be used where the design maturity of the system is well defined or a requirement to use existing systems/COTS is in place.

**5.2.2** A description of the requirements development process for the item to be developed, produced, or purchased with particular attention to the participatory level of the supplier in defining and understanding the requirements. In particular the current state of maturity and timeliness of the requirements for each supplier item should be addressed.

**5.2.2.1** A description of how Key Performance Parameters and Critical Design Features are to be jointly defined and characterized by Offeror and his suppliers.

**5.2.2.2** A description of the process by which the supplier will define critical manufacturing and assembly processes, and how they will be controlled.

**5.2.3** A detailed plan for the efforts to be conducted under the risk reduction contract, with ties to the IMP/IMS for each supplier subsystem or component. This should highlight efforts necessary to fully characterize (margins and sensitivities) the product design. The following shall be included in the description of the supplier activities.

**5.2.3.1** A description of the intended approach to acceptance testing of the supplier provided item.

**5.2.3.2** A description of the qualification approach for the supplier provided item.

**5.2.3.3** An asset utilization matrix for the supplier risk reduction activity.

**5.2.4** A description of how each supplier will incorporate the system/subsystem plans to ensure vertical consistency of approach to the development of the weapon.

**5.2.5** A description of how each supplier will be integrated into the overall cost goals of the program.

**5.2.6** A description of the configuration definition and control system to be used by the supplier, and explanation of how it will work with the Offeror's system to ensure timely and accurate configuration control with government visibility into all Configuration Management (CM) activities, including the Configuration Status Accounting System (CSAS).

**5.2.7** A description of how changes to the subcontract requirements are effected, with attention to timeliness and the treatment of Intellectual Property.

**5.2.8** A description of the interfaces of the supplied item to the weapon, how those interfaces will be controlled and characterized.

**5.2.9** A detailed description of how the Offeror will manage the cost of the supplier activity, as a part of the larger EVMS activity on the program.

**5.2.10** A detailed description of how the Offeror will conduct Manufacturing Readiness Level (MRL) assessments of key suppliers in a manner consistent with the DoD MRA/MRL Deskbook.



### **5.3 Section M**

The Offeror's Supply Chain Management Plan will be evaluated for its completeness, process/practice consistency, and overall ability to deliver the product on schedule and cost. This evaluation will consider, but not be limited to, the following:

**5.3.1** The Offeror's make-buy decision process should be consistent with company and subcontractor strengths and weaknesses, best value for the government, and should minimize program schedule and performance risks. The proposal should demonstrate the Offeror's insight into the subcontractor's corporate health, business and engineering practices, and demonstrate management agreements that will reduce government risks and ensure adequate program insight on the part of both the prime contractor and the government.

**5.3.1.1** Items selected for subcontracting should be described in sufficient detail to understand what is being proposed for subcontracting and the expectation and level of effort being placed on the subcontractor.

**5.3.1.1.1** Claims of new development and reuse should be supported by factual, quantitative data. Assessments of the existing state of maturity of the item to be delivered under subcontract should be supported by test data, with additional consideration for third party verification.

**5.3.2** The extent to which the supplier has been involved in the requirements definition process to produce an understanding of the requirements and their origin. The thoroughness, timeliness, and control of requirements development and maintenance, to include derived requirements for manufacture and assembly.

**5.3.2.1** The extent to which subcontractors and suppliers have been involved in the definition of Key Performance Parameters and Critical Design Features, the analyses of their impact on system performance, and redesign efforts to improve performance and producibility. The process should reflect an iterative approach to their interaction, an open exchange of technical information and a willingness to seek consensus and/or compromise.

**5.3.2.2** The evaluation of supplier's processes to identify critical manufacturing and assembly processes, their plan to mitigate the effects of those processes, including monitoring related parameters, and feedback processes to control variation in the process or product.

**5.3.3** The reasonableness on IMS/IMP activities with supplier activities integrated, and consistency of program cost driving assumptions with necessary development tenants.

**5.3.3.1** The evaluation of the development process for acceptance testing to identify defective parts, to eliminate rework/scrap/reprocessing, and ensure performance compliant end items. The approach should address internal (within the supplier system) and external (prime contractor or government) feedback mechanisms.

**5.3.3.2** The qualification approach for the supplier provided item is adequate to ensure the item will design and interface specifications, and ensure suitability for application to the end item.

**5.3.3.3** The sufficiency of assets planned for use in all proposed risk reduction activities to provide data for verification of key design parameters.

**5.3.4** The extent to which the Offeror has shared program plans with the supplier as requirements, to achieve a consistency of approach through the entire program.

**5.3.5** The extent to which the Offeror and Supplier will work together on efforts to ensure program cost goals are met.

**5.3.6** The Offeror's proposal will be evaluated on the adequacy and efficiency of their Configuration Management processes and government visibility into the configuration management activities of all suppliers. The Offeror will provide standard clauses and/or language that is applied to subcontracts and/or purchasing requests. The offer will identify the list of key subcontractors and suppliers and the intended application to ensure coverage of configuration identification, configuration control, status accounting and configuration reviews and audits. The Offeror will require visibility to configuration documentation or information systems that supports the configuration requirement of the RFP.

**5.3.7** A formal requirements control process between the Offeror and subcontractor is defined. The approach should include a process to identify Intellectual Property and the degree of protection it requires. The approach also maintains a balance between adequate protection and appropriate levels of insight to manage development and production efforts. The level of insight should allow for open exchange of design information and adequate risk mitigation by both the government and prime.

**5.3.8** The process for interface definition allows for prime/supplier interchange during requirements definition, design development and maturation, and integration and verification processes. Interface characterization should be adequate to facilitate production specification development, acceptance test procedure development, and FCA/PCA baseline development. The process should place interface definitions and characteristics under a formal process control early in the design process.

**5.3.9** The integration of the supplier EVMS activity into the program reporting and control efforts will be evaluated.

**5.3.10** The MRA approach should demonstrate an understanding on the part of the Offeror and suppliers of key requirements for the targeted MRLs. Entrance and exit criteria/activities for each MRL should cover all ten threads identified in the Deskbook. This element will evaluate the adequacy of the Offeror's process and plans to ensure supplier target MRL as described in DoD MRA/MRL Deskbook. This element is met when the Offeror's proposal clearly identifies

and substantiates its supplier MRL assessment plan and will ensure maturity plans will be executable within time and resources allocated to achieve the target MRL by the end of the effort.

## **5.4 Statement of Objectives**

**5.4.1 Supplier Management.** A supplier management program shall be established, implemented and maintained to track and report supplier performance. This program shall include the identification of major/critical suppliers as well as suppliers with critical processes. The program shall implement processes to:

- 5.4.1.1** Communicate program requirements to all suppliers, including timely notification of changes.
- 5.4.1.2** Assure supplier compliance with program requirements, including sub-tier suppliers.
- 5.4.1.3** Continuously assess overall health of supplier management organization.
- 5.4.1.4** Identify and manage supplier risks.
- 5.4.1.5** Address how management of the supply-chain will be executed and monitored.
- 5.4.1.6** Provide status of supply-chain management at all program reviews.

**5.4.2 Supplier Quality.** A program to assess supplier quality shall be established and maintained. This program shall include, as a minimum:

- 5.4.2.1** Flow down of key characteristic (KC) requirements to suppliers.
- 5.4.2.2** Approval of suppliers' procedures to control KCs.
- 5.4.2.3** Flow down of first article inspection requirements to suppliers and Lot Acceptance Test (LAT) sample testing for one-shot devices.
- 5.4.2.4** Use of predictive indicators to provide early detection of potential quality problems at suppliers.
- 5.4.2.5** Objective parameters to assess the overall health of the supplier quality program.
- 5.4.2.6** The procedure for delegating Material Review Board authority to qualified suppliers.

## 5.5 DIDs

[DI-MGMT-80004](#) [Management Plan](#)

A dedicated DID for a Supply Chain Management Plan does not exist. Tailor this generic management plan to address supply chain management.

## 5.6 References

AFMCI 63-1201 – Implementing Operational Safety, Suitability and Effectiveness (OSS&E) and Life Cycle Systems Engineering (LCSE)

<http://www.e-publishing.af.mil/shared/media/epubs/AFMCI63-1201.pdf>

AF SEAM – Air Force Systems Engineering Assessment Model (Releasability restrictions unknown. Contact Air Force Center for Systems Engineering, WPAFB, OH 45433)

DoD MRA Deskbook (Releasability restrictions unknown. Contact DoD, Office of the Director, Defense Research and Engineering)

AFMCI 63-501 (Distribution F. Contact HQ AFMC/ENPD)

AFI 63-501 (Distribution F. Contact SAF/AQXM)

AAC Standard Systems Engineering Processes and Practices (SSEPP)  
(Distribution D. Contact AAC/EN, Eglin AFB, FL 32542)

AAC/CC Memorandum, Acquisition Changes to Improve Reliability, Manufacturing, and Safety, 17 March 2008 (Releasability restrictions unknown. Contact AAC/EN, Eglin AFB, FL 32542)

## **6.0 SAFETY PROGRAM PLAN**

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### **6.1 Introduction**

This chapter contains content to consider for establishing a contractual systems safety program in RFPs. The information in the chapter is consistent with and captures the relevant requirements from MIL-STD-882, AFI 91-202 (Chapter 9) and its AFMC supplement, AAC SSEPP, AFMCI 63-1201, and AF SEAM. Systems Safety is part of the systems engineering process and, as such, this chapter has content that relates to the content in the Systems Engineering Management Plan and Risk Management Plan chapters. Therefore, the program office should ensure consistency of requirements among these related chapters.

### **6.2 Section L**

The Offeror shall provide a detailed System Safety Program Plan (SSPP) that demonstrates that adequate consideration is given to safety for the proposed design throughout the life cycle of the program. The proposal must portray the Offeror's ability to execute a disciplined, timely, and effective safety program in accordance with MIL-STD-882 and applicable safety-related statutory requirements to include identification, control, and mitigation of Environment, Safety, and Occupational Health (ESOH) risks. The Offeror's SSPP shall detail the scope, processes, and detail that will be used to ensure an adequate design level of system safety, concurrency with the systems engineering effort, and an effective hardware/ human interface, for all safety critical hardware/software/firmware/functions. The Offeror's SSPP shall address the ability to execute hazard abatement actions to include identification of significant risks (including root cause), definition of methods for coping with each risk (technical acceptability), risk monitoring, communication to stakeholders, and risk tracking with effective metrics toward progress resolution. The Offeror's SSPP shall also identify the artifacts required to demonstrate that program overall design safety levels have been achieved. Elements to be addressed in the SSPP include, but are not limited to, the following:

**6.2.1** Describe depth and scope of the Offeror's system safety program, including the work tasks applicable to the program's phases.

**6.2.2** Provide an overall system description of the proposed design, highlighting those components/ subsystems considered to be hazardous, housing or controlling safety critical functions, and interfaces that are initially considered to be safety critical or posed potential safety risks.

**6.2.3** Identify critical safety items and critical safety characteristics of the proposed design.

**6.2.4** Summarize safety requirement documents applicable to the Offeror's design, development and demonstration efforts, including manufacturing. These will include federal, state, and local statutory safety requirements. Documents shall be identified as directives when directed by the program contract or are federally mandated requirements which are not specifically called out.

**6.2.5** Describe the system safety engineering organization, including the reporting lines from both a programmatic and functional perspective. Specify responsibilities and tasks of the system safety engineering organization, including both contractually specific and general safety tasks. Address how the system safety process will be implemented throughout the system life cycle.

**6.2.6** Describe the Offeror's ability and resources required to support technical studies, presentations, and participation at SSWGs, NNMSB, and WSESRB/FISTRP meetings.

Joint programs with the U.S. Navy (USN) will, most likely, require safety review by the USN Weapon System Explosives Safety Review Board (WSESRB). Support to the WSESRB may include supporting several technical panels (Fuze Initiation System Technical Review Panel (FISTRP) and Software Systems Safety Technical Review Panel (SSSTRP)). A significant amount of contractor support may be necessary to support these reviews. Early planning is paramount since detailed technical data, is needed to perform independent government safety studies and analyses in support of Non-Nuclear Munitions Safety Board (NNMSB) and WSESRB safety approval/certification recommendations.

**6.2.7** Explain how system level safety requirements are flowed to subcontractors/vendors and how they participate in the system safety effort.

**6.2.8** Identify the staffing level of system safety engineers required to support the system safety program during each phase of the program.

**6.2.9** Provide an overall program schedule highlighting the safety performance demonstrations and safety-related qualification testing activities, to include delivery of relevant detailed analyses/reports.

**6.2.10** Identify the system safety design criteria to be used for the proposed design. The criteria shall include a full definition of all safety-related terms used on the program to ensure a common understanding between the government and the Offeror.

Arming & Fuzing and Ignition System Devices require compliance to MIL-STD-1316 and MIL-STD-1901, respectively. These requirements may drive cost if not planned early. Consult with AAC Systems Safety office as early as possible.

**6.2.11** Identify the system safety design requirements. The requirements shall include system-level, software safety coding, hardware for programmable logic devices, and related functional requirements.

The use of programmable logic devices (PLDs) in fuzes and initiation systems for safety critical functions/components shall be in accordance with the Fuze Engineering Standardization Working Group guidance for the use of PLDs.

**6.2.12** Describe the planned hazard analyses/reports, their scope and depth, and their timing. Highlight the scope of each hazard analysis or report prepared in support of the program. At a

minimum, the following analyses/reports should be developed: Preliminary Hazard Analysis (PHA), Safety Requirements/Criteria Analysis (SR/CA), Subsystem Hazard Analysis (SSHA), System Hazard Analysis (SHA), Operating & Support Hazard Analysis (O&SHA), and Safety Assessment Report (SAR). The software safety effort associated with the program shall be documented in both the PHA and SHA.

When requiring specific safety analyses, such as the fault tree analysis (FTA), specify which system and/or subsystem the analysis is to be conducted. In addition, specify the candidate top event for the FTA, such as inadvertent arming; consult with AAC Systems Safety office. Be aware that, depending on the system, the AAC Systems Safety office may elect to conduct the FTA with direct contractor support.

**6.2.13** Describe the proposed method to verify that all identified safety requirements, both contractually specified and derived requirements, have been successfully achieved.

**6.2.14** Identify any special safety training required to support the program, the resources used to derive the training, and the organization responsible for preparing the training.

**6.2.15** Identify how the system safety organization supports testing. Address unique test range safety, safety aspects of the test program, and include Explosive Ordnance Disposal (EOD) requirements. Include a description of how the test program supports the hazard abatement and/or analyses process.

Development of technical data for EOD may require independent testing of certain safety devices. All-Up-Round (AUR) assets may also be required to verify EOD procedures; this may require test range time along with assets. Consult early with the responsible EOD organization to identify and define the resources required. Delivery of components may require a dedicated Contract Line Item Number (CLIN). Be aware that two EOD organizations are involved in weapons testing: that of 1) the specific test range, and 2) for fielding, EODTECHDIV at Indian Head.

**6.2.16** As applicable, describe the process for obtaining test range safety approval. This shall include the directives and guidance requirements to be met, identification of a flight termination system, unique handling storage, preservation, maintenance, and the analyses to be performed to satisfy government test range planning requirements.

**6.2.17** As applicable, describe the Offeror's approach for addressing determination of Explosive Hazard Classification, energetic material(s)/article(s) qualification and other related energetic material/weapon tests, including Insensitive Munitions (IM) requirements. This approach shall include a preliminary listing of all energetic material considered for the system, the Offeror's understanding of the explosive hazard classification process, the materials and documentation provided in support of the EOD training and documentation, and the support given to the system's demilitarization/disposition plan.

As applicable, energetics hazard classification shall comply with TO 11A-1-47, DoD Ammunition & Explosive Hazard Classification Procedures. Also, weapons and/or munitions requiring flight termination system shall comply with RC-319-07.

As applicable, consider harmonizing the testing required in MIL-STD-2105 for Insensitive Munitions (IM) with that of federally mandated requirements in explosive hazard classification 49, Code of Federal Regulations.

**6.2.18** The Offeror shall describe the top preliminary hazard risks and describe design mitigation strategies for each. Using the above Section L criteria, include candidate hazards for detailed analysis and demonstration.

### **6.3 Section M**

The proposal(s) will be evaluated to determine the Offeror's ability to conduct a system safety program that meets and complies with the Statement of Objectives (SOO)/Statement of Work (SOW) requirements. The Offeror's SSPP will be evaluated for the extent to which the proposal demonstrates a clear understanding of the processes required to establish and maintain an acceptable level of design safety and risk for the program and that the Offeror has a thorough understanding of the complexity and depth required for an effective and successful system safety program.

**6.3.1** The Offeror's proposal will be evaluated on the adequacy of the depth and scope of the system safety program, including the work tasks applicable to each of the program's phases.

**6.3.2** The Offeror's proposal will be evaluated on the adequacy of an overall system description of the proposed design, highlighting those components/subsystems considered to be hazardous and those interfaces that are initially considered to be safety critical.

**6.3.3** The Offeror's proposal will be evaluated on the adequacy of the identification of critical safety items and critical safety characteristics of the proposed design.

**6.3.4** The Offeror's proposal will be evaluated on the adequacy of the summary of safety requirement documents applicable to the proposed design, development and demonstration efforts, and manufacturing. These should include federal, state, and local statutory safety requirements.

**6.3.5** The Offeror's proposal will be evaluated on the adequacy of the system safety engineering organization, including the reporting lines from both a programmatic and functional perspective. Specify responsibilities and tasks of the system safety engineering organization, including both contractually specific and general safety tasks. How the system safety process will be implemented throughout the system life cycle shall be evaluated.



**6.3.6** The Offeror's proposal will be evaluated on the adequacy of the Offeror's ability and resources required to support technical studies, presentations, and participation at System Safety Working Group (SSWG) and Non-Nuclear Munitions Safety Board (NNMSB) meetings. For joint programs with the U.S. Navy, the Offeror's ability and resources required to support technical studies, presentations, and participation at Weapon System Explosives Safety Review Boards (WSESRBs), Initiation System Technical Review Panels (FISTRPs), Software Systems Safety Technical Review Panels (SSSTRPs), and other systems safety meetings shall be evaluated.

**6.3.7** The Offeror's proposal will be evaluated on the adequacy of the how system-level safety requirements are flowed to subcontractors/vendors and how they participate in the system safety effort.

**6.3.8** The Offeror's proposal will be evaluated on the adequacy of the staffing level of system safety engineers required to support the system safety program during each phase of the program.

**6.3.9** The Offeror's proposal will be evaluated on the timeliness of safety related events (e.g., safety analyses, performance demonstrations, and safety-related qualification testing activities) necessary to support technical reviews, safety board certifications, and other major programmatic related decision meetings.

**6.3.10** The Offeror's proposal will be evaluated on the thoroughness of the system safety design criteria to be used for the proposed design. The criteria shall include a full definition of all safety-related terms used on the program to ensure a common understanding between the government and the Offeror. For proposed designs with arming, fuzing, and ignition system devices, the understanding and ramifications of compliance to specific systems safety military standards MIL-STD-1316 and MIL-STD-1901 will be assessed.

**6.3.11** The Offeror's proposal will be evaluated on the adequacy of indentifying the system safety design requirements. The requirements shall include system-level, software safety coding, hardware for programmable logic devices (PLDs), and related functional requirements. PLDs in fuzes and initiation systems for safety critical functions/components shall be in accordance with Fuze Engineering Standardization Working Group guidance.

**6.3.12** The Offeror's proposal will be evaluated on the adequacy of the planned hazard analyses/reports, their scope and depth, and their timing. The scope of each hazard analysis or report prepared in support of the program shall be highlighted. At a minimum, the following analyses/reports should be developed: Preliminary Hazard Analysis (PHA), Safety Requirements/Criteria Analysis (SR/CA), Subsystem Hazard Analysis (SSHA), System Hazard Analysis (SHA), Operating & Support Hazard Analysis (O&SHA), and Safety Assessment Report (SAR). The software safety effort associated with the program shall be documented in both the PHA and SHA.

**6.3.12.1** When requiring specific safety analyses, such as fault tree analysis (FTA), specify in which system and/or subsystems the analysis is to be conducted.

**6.3.12.2** For specific safety analyses, specify the candidate top event for the safety analyses, such as inadvertent arming.

**6.3.13** The Offeror's proposal will be evaluated on the thoroughness of the method to verify that all identified safety requirements, both contractually specified and derived requirements, have been successfully achieved.

**6.3.14** The Offeror's proposal will be evaluated on the adequacy of identifying any special safety training required to support the program, the resources used to derive the training, and the organization responsible for preparing the training.

**6.3.15** The Offeror's proposal will be evaluated on the adequacy of how the system safety organization supports testing. Address unique test range safety, safety aspects of the test program, and Explosive Ordnance Disposal (EOD) requirements. A description of how the test program supports the hazard abatement and/or analyses process should be included. The Offeror's understanding of the assets and resources required to adequately support safety-related testing shall be assessed.

**6.3.16** As applicable, the Offeror's proposal will be evaluated on the adequacy of the understanding of the process for obtaining test range safety approval. This shall include understanding the directives and guidance requirements to be met, identification of the flight termination system, unique handling storage, preservation, maintenance, and the analyses to be performed to satisfy government test range planning requirements.

**6.3.17** As applicable, the Offeror's proposal will be evaluated on the approach for addressing determination of Explosive Hazard Classification, qualification of energetic material(s)/article(s), and other related energetic material/weapon tests, including Insensitive Munitions (IM) requirements. A complete approach includes a preliminary listing of all energetic materials considered for the system, the Offeror's understanding of the explosive hazard classification process, the materials and documentation provided in support of the EOD training and documentation, and the support given to the system's demilitarization/disposition plan.

**6.3.18** The Offeror's proposal will be evaluated on the description of the top preliminary hazard risks and the description of design mitigation strategies for each. Include candidate hazards for detailed analysis and demonstration.

## **6.4 Statement of Objectives**

Design, develop, and demonstrate a safe, environmentally compliant system and evaluate the potential Environment, Safety, and Occupational Health (ESOH) risks, propose cost-effective hazard controls and solutions for mitigation, and a design to reduce or eliminate risks. Employ MIL-STD-882 safety approach and integrate safety design and development efforts concurrent

with the systems engineering efforts. Demonstrate degree of systems safety design and performance of all safety devices. Ensure participation and technical support to independent government safety review boards and systems safety groups by providing or making available detailed safety-related design data, studies, analyses, and testing of all safety critical functions, devices, and energetic materials. Plan, conduct, and support testing for determination of Explosive Hazard Classification of all energetic materials used in the system, to include providing supporting technical data. Ensure critical safety items are identified in appropriate drawings and specifications. Ensure that systems/munitions requiring flight termination system(s) comply with the test range safety requirements of RC-319-07, as applicable.

If a SOW is used, consider the following:

- a. The contractor shall establish/Conduct a System Safety Program (IAW MIL-STD-882) as an integral part and concurrent with the systems engineering efforts throughout the life cycle of the system.
- b. The contractor shall Identify, quantify, analyze, and track credible potential hazards and brief status at key program milestones and major technical reviews.
- c. The contractor shall develop safety design criteria, perform detailed hazard analysis, and implement design solutions to eliminate and/or control identified hazards, including flow-down design safety requirements throughout the supply chain.
- d. The contractor shall demonstrate degree of design systems safety and performance of all safety devices. This includes hardware/software/firmware and all associated support equipment.
- e. The contractor shall support and host Systems Safety Group/Systems Safety Working Group and participate in independent safety reviews conducted by government safety review board(s) (e.g., NNMSB, WSESRB). Included are hardware, software, and firmware, energetic materials/substances, arming & fuzing devices, ignition systems, and other safety-related devices.
- f. The contractor shall provide for safety engineer participation in configuration control board and in the review of engineering change proposals to ensure design changes do not degrade design safety levels. The contractor shall identify Critical Safety Items in appropriate drawings and specifications.

As applicable → The contractor shall provide technical data, plan/conduct/support testing for determination of Explosive Hazard Classification. Harmonize test resources for both hazard classification and Insensitive Munitions (IM) requirements and support independent test planning working meetings and test scoring efforts.

Ensure that the System Safety Program Plan (SSPP) tasks are integrated and performed concurrent with the systems engineering effort and activities in sync with program milestones. Safety reviews are best scheduled in conjunction with major design reviews, such as the system design review, preliminary design review, and

critical design review. Consideration should also be given to scheduling the safety reviews in concert with relevant safety approval milestones.

Ensure critical safety items (Public Law 108-136 Sect 802) are identified in appropriate drawings and specifications. Levy appropriate contract clauses; e.g., DFAR 209.270 (preferred method) or develop appropriate SOW/CDRL. Ensure changes to identified/approved safety critical items are subject to Engineering Change Proposal (ECP) Class I review/approval process.

AFI 91-202 and its AFMC supplement require that a System Safety Group (SSG) be established. The SSG is an advisory group to the Program Manager (PM) and meets at least annually to evaluate hazards, recommend corrective actions, and assists in prioritizing hazards. Participation from weapon developers is critical. The PM, deputy, or engineering director/chief engineer chairs the meeting. Note that the USAF Non-nuclear Munitions Safety Board (NNMSB) may act as the SSG for all non-nuclear munitions. SSG will generally form a System Safety Working Group (SSWG) to work specific problems separately and report back to the SSG. An SSWG augments an SSG; it is not a substitute.

Munitions/weapon systems containing hazardous or energetic materials, including Flight Termination Systems and related support equipment, undergo detailed independent government approvals, certifications and have very specific and/or (e.g., statutory, DoD, range) requirements. Likewise, Directed Energy Weapons (DEW), as well as certain laser designators, also has unique certification and/or testing requirements. Arming & Fuzing and Ignition System Devices require compliance to specific systems safety MIL-STDs, MIL-STD-1316 and MIL-STD-1901, respectively. These requirements may drive cost if not planned early—consult with AAC Systems Safety office as early as possible. Likewise, the use of programmable devices in fuzes and initiation systems in safety critical logic components shall be in accordance with the Fuze Engineering Standardization Working Group guidance for the use of programmable logic devices (PLDs).

## **6.5 DIDs**

The following Data Item Descriptions (DID) are associated with configuration management and associated safety output products. The detailed format and content requirements for each can be obtained by using the link below.

<https://assist.daps.dla.mil/quicksearch/>

Each DID selected will require completion of DD form 1423 and can be found with instructions at the following link.

<http://www.dtic.mil/whs/directives/infomgt/forms/eforms/dd1423.pdf>

[DI-SAFT-80101](#) [System Safety Hazard Analysis Report](#)

**CDRL REMARKS:** DID must be tailored for specific analyses to perform, such as the preliminary hazard analysis, system hazard analysis, etc.

[DI-SAFT-80102](#)                      [Safety Assessment Report](#)

[DI-SAFT-80103](#)                      [Engineering Change Proposal System Safety Report](#)

**CDRL REMARKS:** Use or combine with the overall systems engineering ECP effort. Ensure identified and approved safety critical item changes and any safety critical function/devices are subject to the Class I approval process.

[DI-SAFT-80104](#)                      [Waiver or Deviation System Safety Report](#)

**CDRL REMARKS:** Use or combine with overall systems engineering effort. Reviews of deviations and waivers are essential to ensure that design changes do not degrade the safety level of the system.

[DI-SAFT-80106](#)                      [Occupational Health Hazard Assessment](#)

[DI-SAFT-80181](#)                      [Range Safety Data for Aerodynamic Weapons](#)

[DI-SAFT-80182](#)                      [Technical Data for Munitions \(TDM\)](#)

**CDRL REMARKS:** Technical Data Packages (TDPs) for Munitions are a unique requirement for all munition items to be tested on the AAC complex (AACI 21-202). The TDP is required at least 30 days prior to arrival of the item(s) on Eglin AFB. Contact AAC Safety Office for further information.

[DI-SAFT-80931](#)                      [Explosive Ordnance Disposal Data](#)

**CDRL REMARKS:** Consult early with the applicable/responsible EOD organization to identify and define specific technical data required. Development of technical data for EOD may require independent testing of certain safety devices; e.g., bleed-down times for arming & fuzing circuits and related thermal batteries. All-Up-Round (AUR) assets may also be required to verify EOD procedures; this may require test range time along with assets. Be aware that two EOD organizations are involved in weapons testing—that of the specific test range, and for fielding, EODTECHDIV at Indian Head.

[DI-SAFT-80970](#)                      [Critical Safety Item, Critical Defect Report](#)

[DI-SAFT-81065](#) [Safety Studies Report](#)

**CDRL REMARKS:** The report documents safety related analyses, such as the fault hazard analysis and fault tree analysis. **NOTE:** When requiring specific safety analyses, such as the fault tree analysis (FTA), specify which system and/or subsystem the analysis needs to be conducted on. In addition, specify the candidate top event for the FTA, such as inadvertent arming. Consult with AAC Systems Safety office. Be aware that depending on the system, the AAC Systems Safety office may elect to conduct the FTA with direct support contractor support.

[DI-SAFT-81299](#) [Explosive Hazard Classification Data](#)

**CDRL REMARKS:** Required by 49, Code of Federal Regulations (CFR) for the transportation and storage of hazardous items.

[DI-SAFT-81300](#) [Mishap Risk Assessment Report](#)

[DI-SAFT-81626](#) [System Safety Program Plan \(SSPP\)](#)

[DI-MGMT-81398](#) [Hazardous Material Management Plan](#)

**CDRL REMARKS:** Initial submission due with proposal. Updated as required.

[DI-MISC-80508](#) [Technical Report - Study Services](#)

**CDRL REMARKS:** Typically used to document safety performance testing.

[DI-MISC-80043](#) [Ammunition Data Card](#)

**CDRL REMARKS:** Ammunition Data Card records essential information pertaining to the build of a production component lot or an end-item lot of ammunition, explosive material, or a serially numbered guided missile.

## 6.6 References

Military Standard 882 – Standard Practice for System Safety  
[https://assist.daps.dla.mil/quicksearch/basic\\_profile.cfm?ident\\_number=36027](https://assist.daps.dla.mil/quicksearch/basic_profile.cfm?ident_number=36027)

Military Standard 1316 – Fuze Design, Safety Criteria For  
[https://assist.daps.dla.mil/quicksearch/basic\\_profile.cfm?ident\\_number=36251](https://assist.daps.dla.mil/quicksearch/basic_profile.cfm?ident_number=36251)

Military Standard 1901 – Munition Rocket and Missile Motor Ignition System Design, Safety Criteria For

[https://assist.daps.dla.mil/quicksearch/basic\\_profile.cfm?ident\\_number=106144](https://assist.daps.dla.mil/quicksearch/basic_profile.cfm?ident_number=106144)

Military Standard 2105 – Hazard Assessment Tests for Non-Nuclear Munitions

[https://assist.daps.dla.mil/quicksearch/basic\\_profile.cfm?ident\\_number=72079](https://assist.daps.dla.mil/quicksearch/basic_profile.cfm?ident_number=72079)

AFI 91-202 – The U.S. Air Force Mishap Prevention Program, 1 Aug 98

<http://www.e-publishing.af.mil/shared/media/epubs/AFI91-202.pdf>

AFI 91-205 (Distribution F. Contact HQ AFMC/SEP)

AFMCI 63-1201 – Implementing Operational Safety Suitability and Effectiveness (OSS&E) and Life Cycle Systems Engineering (LCSE)

<http://www.e-publishing.af.mil/shared/media/epubs/AFMCI63-1201.pdf>

AFMC SUP 1 AFI 91-202 – The U.S. Air Force Mishap Prevention Program, Sup 11 Nov 05

[http://www.e-publishing.af.mil/shared/media/epubs/AFI91-202\\_AFMCSUP\\_1.pdf](http://www.e-publishing.af.mil/shared/media/epubs/AFI91-202_AFMCSUP_1.pdf)

AACI 21 – 202 (Distribution F. Contact AAC/SEOW, Eglin AFB, FL 32542)

AF SEAM – Air Force Systems Engineering Assessment Model (Releasability restrictions unknown. Contact Air Force Center for Systems Engineering, WPAFB, OH 45433)

RC 319-07 – Range Commander Council Flight Termination Systems Commonality Standard 319-07, Aug 07 (Distribution C. Contact AAC/SE, Eglin AFB, FL 32542)

Fuze Engineering Standardization Working Group guidance for the use of PLDs (Distribution C. Contact AAC/SE, Eglin AFB, FL 32542)

## **7.0 CONFIGURATION MANAGEMENT PLAN**

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### **7.1 Introduction**

This chapter contains content to consider for configuration management, interface management and technical data management in RFPs. The information in the chapter is consistent with and captures the relevant requirements from the AAC SSEPP, AFMCI 63-1201 and the AF SEAM. This chapter has content that relates to content in the Systems Engineering Management Plan chapter, the Supply Chain Management chapter and the Integrated Characterization, Maturation, Verification chapter. Ensure modification of content in this chapter is assessed against these related chapters.

### **7.2 Section L**

The Offeror shall propose a detailed CMP in a format consistent with the Offeror's internal procedures to sufficiently describe the Configuration Management processes to be employed on the program using the guidance of MIL HDBK 61A(SE) and DOD STD 2101(OS). The plan should detail the time phased activities necessary at all levels of the supply chain to define and control the configuration. Elements to be addressed in the plan include but are not limited to the following:

**7.2.1** The methodology used for the selection of Configuration Items (CIs), the types of documentation for each CI, the discrete numbering system used for CI identifiers and the process for determining configuration baselines.

**7.2.2** The serialization and traceability strategy for the system and subsystems for supportability for fielded units.

**7.2.3** A description of the processes used for Configuration Change Control to ensure the release configuration documentation are properly identified, documented, evaluated for impact, approved at an appropriate level of authority, incorporated and verified.

**7.2.4** A description of the methodology the Offeror will use to impose configuration management requirements on all suppliers to ensure all appropriate processes are in place that allows both the contractor and government visibility into the configuration management activities of the suppliers.

**7.2.5** A description of the processes used for Configuration Status Accounting (CSA) required to manage CIs (hardware and software) effectively.

**7.2.6** A description of the processes and milestones to be used for Functional and Physical Configuration Audits.

**7.2.7** A description of the processes and documentation to be used for Interface Management.



**7.2.8** A description of the processes and documentation to be used for Technical Data Management.

**7.2.9** A description of configuration management of factory test equipment and test assets (Hardware and Software) to include subcontractors.

### **7.3 Section M**

The Configuration Management Plan will be evaluated to determine the adequacy of processes for establishing and maintaining consistency of a system's performance, functional and physical attributes with its requirements, design, and operational information throughout its life cycle. The evaluation will include configuration management processes, to include all suppliers that ensure designs are traceable to requirements, changes are controlled and documented, interfaces are defined and understood, and documentation is consistent with the product. Elements to be evaluated in the Configuration Management Plan include the following:

**7.3.1** The Offeror's proposal will be evaluated on their process maturity for the selection of Configuration Items (CIs), the documentation content for each CI, the compatibility of the discrete numbering system used for CI identifiers to the standardized government Unique Identification (UID) system described in MIL-STD-130 and how the configuration baseline process is managed to effectively control the baseline and provides for government oversight.

**7.3.2** The Offeror's proposal will be evaluated on the adequacy of the serialization and traceability strategy for the system and subsystems to allow for future as built record reviews, field replacements, repairs/ reworks, or configuration changes.

**7.3.3** The Offeror's proposal will be evaluated on the adequacy of their Configuration Change Control processes for Engineering Change Proposals (ECP) and Requests for Deviations and Waivers (RDW). The government will assess the Offeror's proposed processes and procedures to identify configuration Class I and Class II changes, how the proposed change is documented, the methods used to evaluate the change for impact, the appropriate level of authority for approval and interface with the government, and the process to ensure the change is incorporated and verified. Relative to Class II (singularly and cumulatively) changes the government will assess the robustness of the change classification against potential design and manufacturing margins.

**7.3.4** The Offeror's proposal will be evaluated on the adequacy and efficiency of their Configuration Management processes and government visibility into the configuration management activities of all suppliers. The Offeror will provide standard clauses and/or language that is applied to subcontracts and/or purchasing requests. The offeror will identify the list of key subcontractors and suppliers and the intended application of the clauses/language to ensure coverage of configuration identification, configuration control, status accounting and configuration reviews and audits. The Offeror will require visibility to configuration documentation and information systems that supports the configuration requirement of the RFP.

**7.3.5** The Offeror's proposal will be evaluated on the adequacy of the Configuration Status Accounting (CSA) required to manage CIs (hardware and software) effectively. The CSA system should at a minimum record approved configuration documentation and identification numbers, the status of proposed ECPs, change documents, and RDWs to the configuration, the status of approved changes and the configuration of all hardware (units) and software of the CI in the operational inventory.

**7.3.6** The Offeror's proposal will be evaluated on the planned processes and milestones to be used for Functional Configuration Audit (FCA) and Physical Configuration Audit (PCA). The government will assess the plan's description of the processes and milestones to be used for the Functional, Allocated and Product baselines for the system. At a minimum the plan will be evaluated for configuration management control of the form, fit, function and margin (F<sup>3</sup>M) characteristics and cost of CIs, the functional characteristics designated for production acceptance testing, the production acceptance test requirements and the characterization/ maturation/ verification (CMV) of the test assets. The plan should address government participation in the Functional Configuration Audit (FCA) and Physical Configuration Audit (PCA) to ensure the audits are conducted by the contractor.

Margin in F<sup>3</sup>M is defined as the capability of a product design in excess of "design-to" requirements and includes the extremes of variation in manufacturing and assembly processes.

**7.3.6.1** The Offeror's proposal will be evaluated on the adequacy of a plan for the FCA to verify that the actual performance of the system meets the system requirements. The Offeror's proposal will be evaluated on the following:

**7.3.6.1.1** A system-level FCA to include summaries of subsystem FCAs conducted by the contractor.

**7.3.6.1.2** The existence of a process to include participation of the government team in FCAs below the system level when warranted by subsystem complexity and risk.

**7.3.6.1.3** The schedule timeline for the FCA following the completed system level testing activities used for system verification of requirements.

**7.3.6.1.4** The incorporation of the Systems Verification Plan (SVP) and Requirements Verification Matrix (RVM) to be used at the FCA.

**7.3.6.2** The Offeror's proposal will be evaluated on the adequacy of the PCA to verify that the hardware and software match the technical data package used in the fabrication, assemble, inspection and test of system hardware and generation of system software. The PCA will be conducted after the FCA to ensure the system performance verified by the FCA is consistent with hardware and software generated by the contractor's technical data package.

**7.3.7** The Offeror's proposal will be evaluated on the adequacy of the plan to describe the processes and documentation to be used for Interface Management. At a minimum the plan

shall describe how the Offeror identifies, develops, and maintains the external and internal interfaces necessary for system operation. The offer shall address the following:

**7.3.7.1** External interfaces, such as aircraft systems, mission planning systems, reprogramming systems, and internal interfaces.

**7.3.7.2** All external interfaces for the system established by the Interface Control Working Group (ICWG) are described and documented in the Interface Control Document (ICD).

**7.3.7.3** All internal interfaces to the maximum extent possible required for weapon system development use a Modular Open Systems Approach (MOSA).

**7.3.8** The Offeror's proposed plan will be evaluated on the adequacy of the processes and documentation to be used for Technical Data Management. The plan will be assessed on the contractors processes to document appropriate significant data (to include specifications, drawings, technical orders, test plans/procedures/reports, and models and simulation documentation) as delineated in the RFP as a published list or CDRL, with miscellaneous data relegated to a Data Accession List (DAL) data item. The Offeror's proposed plan will be evaluated on the adequacy of processes and methods to retain and control technical data to include internal configuration management and control of contractor documentation in a repository with government access.

**7.3.9** The Offeror's proposed plan will be evaluated on the adequacy of the internal and subcontractor CM processes and documentation used for the use, maintenance repair and upgrade of factory test equipment and test assets (Hardware and Software).

## **7.4 Statement of Objectives**

The contractor shall develop, maintain, and document a configuration management approach. The approach shall address configuration identification, status accounting, configuration control and reviews and audits. The configuration approach shall address hardware and software of the system as well as the test equipment and test items. The contractors shall ensure implementation of this approach to an appropriate level of the supply chain to ensure proper implementation of change classification. The contractor shall accomplish/support interface management for external and internal interface. The contractor shall support management of technical data including data contained in Contract Data Requirement List and the Data Accession List. The contractor shall retain the data and provide government access to the data repository.

## **7.5 DIDs**

The following Data Items are associated with configuration management and associated reviews and audits. The detailed content requirements for each can be obtained by using the following link:

<https://assist.daps.dla.mil/quicksearch/>

Enter the number into the document number box and select submit.

Each Data Item selected will require completion of DD Form 1423 and can be found with instructions at the following link:

<http://www.dtic.mil/whs/directives/infomgt/forms/eforms/dd1423.pdf>

<a href="#">DI-CMAN-80858B/T</a>	<a href="#">CONFIGURATION MANAGEMENT PLAN (CMP)</a>
<a href="#">DI-CMAN-80639C</a>	<a href="#">ENGINEERING CHANGE PROPOSAL (ECP)</a>
<a href="#">DI-CMAN-80643C</a>	<a href="#">SPECIFICATION CHANGE NOTICE (SCN)</a>
<a href="#">DI-CMAN-80642C</a>	<a href="#">NOTICE OF REVISION (NOR)</a>
<a href="#">DI-CMAN-81218/T</a>	<a href="#">PRODUCT BASELINE INDEX (PBLI)</a>
<a href="#">DI-IPSC-81431A</a>	<a href="#">SYSTEM/SUBSYSTEM SPECIFICATION (SSS)</a>
<a href="#">DI-IPSC-81434A</a>	<a href="#">INTERFACE REQUIREMENT SPECIFICATION (IRS)</a>
<a href="#">DI-CMAN-81248A</a>	<a href="#">INTERFACE CONTROL DOCUMENT (ICD)</a>
<a href="#">DI-ADMN-81250A/T</a>	<a href="#">MEETING MINUTES AND ACTION ITEMS</a>
<a href="#">DI-ADMN-81373/T</a>	<a href="#">PRESENTATION MATERIAL</a>

## **7.6 References**

Military Handbook 61A – Configuration Management Guidance, 7 Feb 2001

[http://assist.daps.dla.mil/quicksearch/basic\\_profile.cfm?ident\\_number=202239](http://assist.daps.dla.mil/quicksearch/basic_profile.cfm?ident_number=202239)

Military Standard 2101 – Classification of Characteristics, 10 May 1979

[http://assist.daps.dla.mil/quicksearch/basic\\_profile.cfm?ident\\_number=37253](http://assist.daps.dla.mil/quicksearch/basic_profile.cfm?ident_number=37253)

Military Standard 130 – Identification Marking of U.S. Military Property, 17 Dec 2007

[http://assist.daps.dla.mil/quicksearch/basic\\_profile.cfm?ident\\_number=35521](http://assist.daps.dla.mil/quicksearch/basic_profile.cfm?ident_number=35521)

AFMCI 63-1201 – Implementing Operational Safety Suitability and Effectiveness (OSS&E) and Life Cycle Systems Engineering (LCSC), 14 Oct 2009

<http://www.e-publishing.af.mil/shared/media/epubs/AFMCI63-1201.pdf>

AF SEAM - Air Force Systems Engineering Assessment Model (Releasability restrictions unknown. Contact Air Force Center for Systems Engineering, WPAFB, OH 45433)

## **8.0 MANUFACTURING AND ASSEMBLY PLAN**

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### **8.1 Introduction**

This chapter contains content to consider for manufacturing readiness and production planning. The information in the chapter is consistent with and captures the relevant requirements and guidance from the AAC SSEPP, AFMCI 63-1201, AF SEAM, AFI 63-501, AFMCI 63-501, AAC/CC Memorandum, and the DoD MRA/MRL Deskbook. When applied for a Technology Development (TD) acquisition phase, prototype systems or appropriate component-level prototyping shall be employed to develop manufacturing processes in a production relevant environment. During the Engineering and Manufacturing Development (EMD) phase, the program is to mature an affordable and executable manufacturing process and conclude with manufacturing processes effectively demonstrated in a pilot line environment. Finally, in the Production and Deployment (PD) phase, transition from low-rate to full-rate production has demonstrated no significant manufacturing risks and that manufacturing processes are under statistical control. The Department of Defense and Air Force acquisition policy and guidance specifies the use of Manufacturing Readiness Levels (MRLs) as a means of consistently and quantitatively measuring the manufacturing maturity and risk during a program's acquisition life cycle. This chapter has content that relates to content in the Systems Engineering Management Plan chapter, the Supply Chain Management chapter, and the Integrated Characterization, Maturation, Verification chapter; therefore, ensure modification of content derived from this chapter is also assessed against these related chapters.

### **8.2 Section L**

**8.2.1** The Offeror shall propose a detailed Manufacturing and Assembly Plan (MAP) in a format consistent with the Offeror internal procedures to sufficiently describe the Manufacturing and Assembly to be employed on the program. The plan should detail the time-phased activities necessary at all levels of the supply chain to produce and maintain the quality and reliability of the verified system configuration. Elements to be addressed in the plan include, but do not need to be limited to, the subparagraphs below.

**8.2.2** Manufacturing Build Plan. The offeror shall propose the methods, schedules, and resources for producing the required products. This plan should address contract delivery rates and changes for future required production rates. This plan should be robust, efficient, and apply the best application of lean manufacturing techniques.

**8.2.3** Manufacturing Capability Assessment and Risk Management. The Offeror shall propose to support and conduct Manufacturing Readiness Level (MRL) assessments of the integrated system and key suppliers in a manner consistent with the DoD MRA/MRL Deskbook. For any MRL that is assessed below the targeted MRL, the Offeror shall identify the current MRL and provide the supporting rationale for the assessment and a manufacturing maturity plan to achieve the targeted MRL.

**8.2.4** Production Cost Modeling. The Offeror shall propose the development and application of a production cost model. This modeling should provide a means to measure, analyze, and predict the contributing elements of the total production cost over the product life-cycle.

**8.2.5** Describe the processes for Key Supplier Identification, Management, and Program Integration

**8.2.6** Describe the processes for Key Characteristics Identification Method, mapping of processes to Key Characteristics, and Supplier Key Characteristic Management.

AS9100C defines a Key Characteristic as an attribute or feature whose variation has a significant effect on product fit, form, function, performance, service life, or producibility, which requires specific actions for the purpose of controlling variation.

All Critical Safety Items (CSIs) should have corresponding KC's identified.

**8.2.7** Describe the Systematic Process Variability Reduction approach and evidence of statistical control.

**8.2.8** Describe the Virtual Manufacturing approach (computer-generated modeling and simulation prior to producing hardware).

**8.2.9** Describe the processes for conducting Design/Manufacturing Trade Studies.

**8.2.10** Describe the processes for Process Failure Mode Effects and Criticality Analysis approach for new processes, modifications to an existing process, or when using an existing process in a new environment, location, or application.

**8.2.11** Describe the Product and Process Verification Approach.

**8.2.12** Describe the processes for Manufacturing Process Control and Continuous Improvement.

**8.2.13** Describe the Factory Efficiency approach (lean factory).

**8.2.14** Describe the processes for Technology Obsolescence and Diminishing Manufacturing Sources.

**8.2.15** The Offeror shall propose a robust Quality Management System to sufficiently describe quality assurance and defect prevention practices critical to a successful program.

### 8.3 Section M

Offerors are expected to describe how information provided applies to the design being proposed, not just boilerplate information.

**8.3.1** The Manufacturing and Assembly Plan (MAP) describes the Manufacturing and Assembly to be employed on the program. The plan detail the time-phased activities necessary at all levels of the supply chain to produce and maintain the quality and reliability of the verified system configuration.

**8.3.2 Manufacturing Build Plan.** This element evaluates the proposed methods, schedules, and resources for producing the required products. This plan should address proposed contract delivery rates and changes for future required production rates. All proposed plans will be evaluated for realism, adequacy, and efficiency as well as demonstration of the use of lean manufacturing techniques. This element is met when the Offeror's proposal:

**8.3.2.1** Describes the major assembly, inspection and test sequence and manufacturing process flows that demonstrate lean manufacturing.

**8.3.2.2** Includes an integrated, achievable schedule incorporating design, tooling, supplier, fabrication, assembly, and delivery milestones (included in IMP/IMS).

**8.3.2.3** Describes facility requirements and facility layouts.

**8.3.2.4** Describes how the Offeror will provide sufficient resources to meet anticipated delivery rates (people, skills, tools, test equipment, facilities, etc.).

**8.3.2.5** Describes environment, health, and safety considerations.

**8.3.2.6** Describes regulatory requirement compliance (environmental, labor law, and security).

**8.3.2.7** Describes manufacturing, producibility, quality, and supplier engineering integration into the design creation process.

**8.3.3 Manufacturing Capability Assessment and Risk Management.** This element evaluates the Offeror's approach to managing manufacturing risk and assessing manufacturing capability. This element is met when the Offeror's proposal:

**8.3.3.1** Describes formal process to identify and manage manufacturing risk, including supplier risks.

**8.3.3.2** Describes how proposed design is consistent with anticipated full rate production volume low cost manufacturing and test techniques.

**8.3.3.3** Describes the approach for incremental verification steps throughout the design and production phases. Typical steps include Manufacturing Management/Production Capability

Reviews, Manufacturing Readiness Assessments, and Production Readiness Reviews. This element will evaluate the adequacy of the Offeror's process and plans to achieve the target MRL as described in DoD MRA/MRL Deskbook. This element is met when the Offeror's proposal clearly identifies and substantiates its MRL assessment and has clearly demonstrated that its maturity plan is executable within time and resources allocated to achieve the target MRL by the end of the effort.

The contractor is expected to have achieved MRL 4 by Milestone A, MRL 5 by PDR, MRL 6 by Milestone B, MRL 7 by CDR, and MRL 8 by Milestone C.

**8.3.3.4** Addresses the following manufacturing capability and risk considerations associated with the proposed approach: industrial base, design stability, design robustness, design producibility, stack-up tolerance analysis, quality management systems, software capabilities, material (e.g., Specialty Metal Act), material and subsystem supplier lead times, technical data package, surge/mobilization capacity, manufacturing technologies, work instructions, labor and facility resources, tooling, process/tooling proofing, measurement, special tooling or test equipment, overall capacity for total production quantities, out-sourcing, and sub-tier supplier management.

**8.3.3.5** Addresses necessary special training and operator certification.

**8.3.4 Production Cost Modeling.** This element evaluates the cost realism, credibility, and usability of the Offeror's production cost model. This element is met when the Offeror's proposed production cost model is defined to:

**8.3.4.1** Provide a tool for production cost prediction.

**8.3.4.2** Provide a tool for analysis of design driven costs and plans for controlling those costs.

**8.3.4.3** Provide a living tool to be used throughout the life of the program.

**8.3.4.4** Provide a tool that addresses recurring, non-recurring, and life cycle costs.

**8.3.4.5** Provide direction on where to focus cost reduction activities.

**8.3.4.6** Provide cost estimates based on planned production methods.

**8.3.4.7** Provides a tool for allocating cost requirements to lower level IPT's and suppliers.

**8.3.4.8** Provides a tool for flow down of affordability requirements, tools, techniques, and practices to appropriate suppliers.

**8.3.5 Key Supplier Identification, Management, and Program Integration.** This element evaluates the Offeror's approach to key supplier identification, management, and program integration and is met when:



The assessment will vary depending on the stage of the program. If entering the Risk Reduction Phase, supplier identification and make/buy decisions usually are not known; however, the processes and decision criteria to be used may be known. In an EMD or production phase the supply chain should be stable and the processes applied should be documented.

**8.3.5.1** The Offeror describes the process for Make/Buy decisions and includes rationale for those Make/Buy decisions which have already been made.

**8.3.5.2** Management control of interdivisional work is described.

**8.3.5.3** Method for key supplier identification is described.

**8.3.5.4** Approach for requirements flow down to key suppliers (including suppliers of government-furnished property) is described.

**8.3.5.5** How key suppliers design tasks, trade studies, risk management, key product and process identification, and sub-tier flow downs are accomplished and integrated into the Offeror's program teaming structure

**8.3.5.6** Method for including key suppliers in the allocation of requirements and design trades as well as resource sharing during the development of the detailed design activities.

**8.3.5.7** Supplier management approach is defined, including assessment of suppliers' cost, schedule, and quality performance.

**8.3.5.8** Requirements for Associate Contractor Agreements with Government-Furnished Property, Equipment Services, and Facilities are defined.

**8.3.5.9** Supplier designs are assessed against their planned production processes and their tolerances, if known at this stage of the program. Supplier designs are assessed for their use of design for manufacturing principles.

The assessment will vary depending on the stage of the program. If in the early Risk Reduction Phase, tolerances of manufacturing processes may not be fully known. If later (post CDR and during Pilot Line Build), more data will be available to assess with respect to manufacturing tolerances.

**8.3.5.10** Plans for key supplier production readiness reviews, first-article inspections, and line proofing are identified.

**8.3.6 Key Characteristics Identification Method**, mapping of processes to Key Characteristics, and Supplier Key Characteristic Management. This element is met when the Offeror:

The expectation for identification/maturity/demonstration of Key Characteristics (KC's) will vary depending on the Program Phase. For example, by SRR, the identification of Key Characteristics should have been initiated. By Milestone B, preliminary Design KC's should be defined. By CDR, potential KC risk issues should have been identified and mitigation plans should be in place. By Milestone C, KC's should be attainable and should have already been demonstrated on a pilot production line. By LRIP, all KC's need to be controlled to appropriate quality levels.

**8.3.6.1** Identifies Key Characteristics defined as a feature of a material, part, assembly, or system in which variation from nominal has adverse impact on fit, performance, reliability, safety or cost of the part.

**8.3.6.2** Identifies how key characteristics are identified on drawings.

**8.3.6.3** Identifies which manufacturing processes create or significantly contribute to each key characteristic.

**8.3.6.4** Identifies how key characteristics are flowed down to suppliers, how key suppliers with design authority identify the key characteristics and processes.

**8.3.6.5** Identifies how key characteristics and processes at suppliers will be managed.

**8.3.7 Systematic Process Variability Reduction Approach.** This element evaluates the Offeror's systematic approach for both in-house and supplier activities to improve product performance, reliability, cost, and the reduction of manufacturing span times, by reducing variation in key characteristics and the processes that create them. This element is met when the Offeror:

**8.3.7.1** Describes how they focus on process variability, continuous improvement, and the use of data and facts to make decisions; e.g., statistical process control.

**8.3.7.2** Describes control plans for critical processes.

**8.3.7.3** Describes how data will be collected to assess key process capability.

**8.3.7.4** Describes how data will be fed back to and used by the designers.

**8.3.7.5** Describes how design tolerances reflect process capability limitations.

**8.3.7.6** Describes how data is utilized to adjust inspection requirements.

**8.3.7.7** Describes the flow down to suppliers.

**8.3.8 Virtual Manufacturing Approach.** This element evaluates the Offeror's utilization of virtual manufacturing in an integrated, synthetic (computer generated, not producing real physical hardware) manufacturing approach. This element is met when the Offeror:

**8.3.8.1** Describes how it will use modeling and simulation to address the properties and interactions among materials, production processes, tooling, facilities, and personnel involved in a new product's design and manufacture before the product and process designs are released.

**8.3.8.2** Describes how virtual manufacturing analysis will be used with the integrated product teams (IPT's).

**8.3.8.3** Describes how virtual manufacturing analysis will be used to demonstrate that the design developed during the early development stage will meet the cost and schedule objectives of the program.

**8.3.9 Design/Manufacturing Trade Studies.** This element evaluates the Offeror's design trade studies in the manufacturing development process to achieve a product design that minimizes total program risk. This element is met when Offeror:

**8.3.9.1** Describes how producibility analysis is included in design trade studies (to include Design for Manufacturing and Design for Assembly (DFM/DFA)).

**8.3.9.2** Describes how design trades focus on robust product designs tolerant to variation in the intended production manufacturing, assembly, test, and usage environments.

**8.3.9.3** Describes how Life Cycle Costs are considered in trade studies.

**8.3.9.4** Describes how suppliers participate in trade studies.

**8.3.10 Process Failure Modes Effects and Criticality Analyses.** – This element is met when Offeror:

**8.3.10.1** Describes how the Offeror's Process Failure Modes Effects and Criticality Analyses is used for identifying, analyzing and preventing failures modes in manufacturing and assembly processes.

**8.3.10.2** Describes what tools the Offeror will use to perform Process Failure Modes Effects and Criticality Analyses.

**8.3.11 Product and Process Verification Approach.** The element evaluates the Offeror's product and process verification approach's ability to provide a degree of assurance that a specific process will consistently produce a product meeting its pre-determined specifications. The element is met when the Offeror:

**8.3.11.1** Describes how product verification will be accomplished with Proof of Manufacturing, First Article Testing, and First Article Inspections.

**8.3.11.2** Describes how process verification will be accomplished through line proofing, virtual modeling and simulations of the production processes, or a combination of the two methods.

**8.3.11.3** Describes how process specifications, work instructions, inspection instructions, and test procedures are audited and controlled to assure they all consistently reflect the engineering drawing requirements.

**8.3.11.4** Describes how the Offeror conducts Hardware Quality Audits (teardown inspections).

**8.3.12 Manufacturing Process Control and Continuous Improvement.** This element evaluates how the Offeror institutes process control, conducts orderly incorporation of improvements in both product and process, and fosters a continuous improvement culture into the program. This element is met when the Offeror:

**8.3.12.1** Describes tools and techniques for continuously controlling and improving manufacturing processes.

**8.3.12.2** Describes methodology for incorporation of process changes.

**8.3.12.3** Describes methodology for encouraging participation from the entire workforce to make improvements in the tasks they are performing and in the ways they are performing them.

**8.3.13 Factory Efficiency Approach (lean factory).** This element evaluates how the Offeror applies lean manufacturing practices and high performance manufacturing systems in its planned production facility. This element is met when the Offeror:

**8.3.13.1** Describes how it will conduct Value Stream Analysis prior to laying out a production floor and developing a manufacturing plan.

**8.3.13.2** Describes how work measurement data will be collected and compare targeted work execution times versus realized time. Will also describe how variances are analyzed to identify inefficiencies, their root causes, and ways to improve performance.

**8.3.13.3** Describes how waste (overproduction, waiting time, transportation, processing, inventory, excess motion, and product defects) will be minimized/eliminated using lean manufacturing techniques.

**8.3.13.4** Describes planned metrics for providing insight into factory efficiency.

AFI 63-501 lists key characteristics, process and metrics as required artifacts.

The AF SEAM contains the following guidance with respect to metrics:

- Ensure the manufacturing processes and procedures adhere to the approved plan(s) to provide a uniform, quality product with consistent performance. Track and report metrics to maintain insight into the manufacturing operations (e.g., actual hours per ship set or lot, realization or efficiency, traveled work, cycle time, scrap/rework/repair, cost of quality, process capabilities (Cpk), MRB dispositions, quality escapes, and first-pass yields).

The AAC IRT memo provides the following guidance with respect to manufacturing metrics:

- Use short list of metrics within the program for critical components.
- Select and track metrics appropriate for the product and program phase (only for new Pre-MS B programs or programs undergoing a restructure).
- Scrap, rework, repair.
- First-pass yield.
- Numbers of non-conformances and dispositions
- Cpk (Key Characteristics)
- Engineering change activity
- Others (risk exposure trends, risk handling action trends, ...)

**8.3.13.5** Describes what factory efficiency data will be shared with the government on an informal basis.

**8.3.14 Technology Obsolescence and Diminishing Manufacturing Sources.** This element is met when the Offeror:

**8.3.14.1** Describes what tools they will employ to analyze the proposed design for Obsolescence and Diminishing Manufacturing Sources in accordance with AFMCI 23-103, Diminishing Manufacturing Sources and Materiel Shortages.

**8.3.14.2** Describes how often Obsolescence and Diminishing Manufacturing Source analysis will be done.

**8.3.14.3** Describes how planning is done for evolutionary designs updates.

**8.3.14.4** Describes a plan to identify, mitigate risk, and report counterfeit parts.

**8.3.15 Quality Management System.** This element evaluates the robustness of the Offeror's basic quality management system and the defect prevention practices critical to successful program execution. This element is met when the Offeror:

**8.3.15.1** Describes how the quality system: assures product quality, achieves stable processes, prevents defects, and employs effective methods for conducting root cause analyses and implementation of corrective actions.

## **8.4 Statement of Objectives**

The contractor shall develop, maintain, and document a manufacturing management program and a quality assurance program that ensure manufacturing and quality are primary considerations in all program decisions.

The following are listed in the AAC SSEPP as mandatory production related requirements which shall be included in any contract where hardware or software is delivered to AAC programs.

- Development of a manufacturing and production strategy that results in a manufacturing and production plan.
- Accomplishment of a production rate analysis that shows how the program achieves baselined delivery rates. This is due within 6 months of the start of the EMD program.
- Delivery of preliminary ATPs prior to CDR; approval of final ATPs at PRR.
- Completion of a stack-up tolerance analysis at the PRR.
- Ability for the government to have direct discussion with the major suppliers in coordination with the prime contractor.
- Documented processes and requirements for product sign-off of DT, OT, and production hardware deliveries (e.g., environmental qualification testing complete, ATPs complete, Functional Configuration Audit (FCA)/PCA complete).
- Creation of an infrastructure and process to investigate system failures once the system is fielded, and troubleshoot/correct deficiencies.

**8.4.1 Manufacturing Readiness Assessments.** The Offeror shall conduct Manufacturing Readiness Assessments to assess MRLs throughout the life of the contract using the DoD MRA/MRL Deskbook as a guide. The Offeror shall specify in a SOW appendix the locations and frequencies of any assessments of manufacturing readiness, along with the resources to perform or support these assessments. The Offeror shall identify its approach for flowing down

these requirements as a function of risk. The Offeror shall address how assessments of manufacturing readiness will be executed and monitored to ensure achieving the required level in accordance with their Manufacturing Maturity Plans. The Offeror should assume that the government will lead the assessment of manufacturing readiness at the prime contractor and the prime contractor will lead the assessments at the suppliers with government participation unless clearly specified differently in the proposal. The Offeror shall address how assessments of manufacturing readiness will be executed and monitored to ensure achieving the required level in accordance with their manufacturing maturity plans. The contractor shall provide status at all program reviews for prime and supplier MRLs and shall re-assess MRLs in areas for which design and process changes have occurred that could impact the MRL. The contractor shall develop and implement manufacturing maturation plans for areas in which the MRL is lower than required to meet Milestone X.

**8.4.2 Manufacturing Development.** The contractor shall implement those processes and systems that consider manufacturing, quality, and design functions in achieving a balanced product design which meets cost, schedule, and performance requirements with acceptable risk. The contractor should consider implementing a Manufacturing and Quality program using MIL-HDBK-896 and the ASC Manufacturing Development Guide as guides. Appropriate practices for implementation may include production cost modeling, identification of key characteristics and processes, variability reduction, electronic simulations of the manufacturing environment, cost/performance/design trade studies, manufacturing capability assessments, product and process validation, Process Failure Modes and Effects Criticality Analysis (PFMECA), control of Obsolescence, Diminishing Manufacturing Sources, and Counterfeit Parts, and key supplier relationships.

A new MIL-STD for Manufacturing and QA is currently in the process of being written (MIL-STD-896). Once released, this MIL-STD should be considered for inclusion in contracts.

**8.4.2.1 Key Characteristics.** KCs shall be identified on the engineering drawings. KCs shall be added or deleted as warranted due to design changes. For each KC, the critical manufacturing processes shall be identified. KCs shall be flowed down to the appropriate level, including to suppliers. Assembly KCs shall flow down to detailed part fabrication KCs. Suppliers with design authority shall be required to identify key characteristics for their designs. Key characteristics shall be used to control the quality of parts designated as safety critical items.

AS9100C defines a Key Characteristic as an attribute or feature whose variation has a significant effect on product fit, form, function, performance, service life, or producibility, which requires specific actions for the purpose of controlling variation.

**8.4.3 Production Quality and Manufacturing Efficiency.** The contractor shall implement those processes and systems to assure program affordability through product quality and manufacturing efficiency. The following elements should be considered as appropriate practices

for implementation: product improvement initiatives; variability reduction on product and process; manufacturing process control and continuous improvement; and key supplier relationships.

**8.4.3.1 Manufacturing Process Control.** All production operations shall be accomplished under controlled conditions. Examples of control techniques include: documented work instructions, adequate production equipment, operator certifications, and statistical process controls.

**8.4.3.2** The contractor shall select and track metrics appropriate for the product and program phase to include the following:

**8.4.3.2.1** Scrap, rework, repair.

**8.4.3.2.2** First-pass yield.

**8.4.3.2.3** Numbers of non-conformances and dispositions.

**8.4.3.2.4** Cpk (Key characteristics).

**8.4.3.2.5** Engineering change activity.

**8.4.3.2.6** Others (risk exposure trends, risk handling action trends ...).

The AAC SSEPP contains specific guidance and requirements for the assessment of yield rates at various stages in the program. The following language is extracted from the AAC SSEPP:

- Poor yield rates affect both the government and the contractors negatively. For the government, low yield rates typically imply the system will not be delivered on time. For the contractor, reputations suffer and there are likely negative impacts to corporate profits. If low corporate profits lead to the contractor choosing to not compete in future contracts or withdrawing from the industrial base entirely, then the infrastructure to make repairs on fielded systems may suffer.
- The contractor team shall implement statistical process controls to track their ability to maintain required yield rates and thus maintain expected corporate profits.
- An assessment of yield rate shall be performed as an exit criterion for SDD.
- An assessment of yield rate shall be performed as an exit criterion for LRIP.

**8.4.4 Quality Systems.** The contractor shall implement an overarching quality system that ensures effective execution, integration, and administration of the design, manufacturing, and deployment processes and systems needed to manage risk, ensure achievement of all performance requirements, and prevent the generation of defective product. The system should also include a means for measuring the effectiveness of and ensuring the continuous improvement of systems and processes. The Quality Management System must address suppliers by flowing down requirements and verifying compliance.



There are three mandatory quality assurance provisions that must be included in each RFP/contract and are usually spelled out in Section E of the contract:

1. The contract quality requirement,
2. The place or places the government reserves the right to perform government contract quality assurance, and
3. The place of acceptance.

#### Contract Requirements:

The category of quality requirements influences both the government contract quality assurance approach and the place of acceptance. The government's program and contracting offices determine which of the four general categories of quality requirements is appropriate for the acquisition involved. Selection of the category of contract quality requirements is based on the criteria for use. The four quality contract requirement categories are:

- Contracts for commercial items (also known as "Commercial"),
- Government reliance on inspection by contractor (also known as "Government"),
- Standard inspection requirements (also known as "Standard"), and
- Higher-level contract quality requirements (also known as "Higher-level")

#### Higher-Level Contract Quality Requirements:

The last category is higher-level contract quality requirements. Requiring compliance with higher-level quality standards is appropriate in solicitations and contracts for complex or critical items or when the technical requirements of the contract require either 1) control of such things as work operations, in-process controls, and inspection or 2) attention to such factors as organization, planning, work instructions, documentation control, and advanced metrology. Complex items have quality characteristics, not wholly visible in the end item, for which contractual conformance must be established progressively through precise measurements, tests, and controls applied during purchasing, manufacturing, performance, assembly, and functional operation either as an individual item or in conjunction with other items.

A critical application of an item is one in which the failure of the item could injure personnel or jeopardize a vital agency mission. A critical item may be either peculiar, meaning it has only one application, or common, meaning it has multiple applications.

When the contracting officer, in consultation with technical personnel, finds it is in the government's interest to require that higher-level quality standards be

maintained, the contracting officer shall indicate in the clause which higher-level quality standards will satisfy the government's requirement. **If appropriate, the SOW/SOO should call out a higher level quality system such as AS9100, with words such as:** "The contractor shall implement an advanced Quality Management System compliant with AS9100C." Avoid specifying "registered" or "certified" to AS9100 since third-party registration is expensive, of unproven value, and the Defense Acquisition Guidebook (DAG) bars requiring third-party registration.

AAC recommends the use of AS9100 for those programs that are deemed to require a Higher Level Contract Quality Requirements clause.

## 8.5 DIDs

[DI-MGMT-80004 Management Plan](#)

A dedicated DID for a Production/Manufacturing Management Plan or a Quality Assurance Plan does not exist. Tailor this generic management plan to address these topics.

## 8.6 References

DoD MRA Deskbook (Releasability restrictions unknown. Contact DoD, Office of the Director, Defense Research and Engineering)

AFMCI 63-1201 – Implementing Operational Safety Suitability and Effectiveness (OSS&E) and Life Cycle Systems Engineering (LCSE)

<http://www.e-publishing.af.mil/shared/media/epubs/AFMCI63-1201.pdf>

AFMCI 63-501 (Distribution F. Contact HQ AFMC/ENPD)

AFI 63-501 (Distribution F. Contact SAF/AQXM)

AF SEAM - Air Force Systems Engineering Assessment Model (Releasability restrictions unknown. Contact Air Force Center for Systems Engineering, WPAFB, OH 45433)

AAC Standard Systems Engineering Processes and Practices (SSEPP) (Distribution D. Contact AAC/EN, Eglin AFB, FL 32542)

MIL-HDBK-896 – Department of Defense Handbook: Manufacturing and Quality Program (8 August 2008)

[http://www.everyspec.com/MIL-HDBK/MIL-HDBK+\(0800+--+0999\)/MIL-HDBK-896\\_17651/](http://www.everyspec.com/MIL-HDBK/MIL-HDBK+(0800+--+0999)/MIL-HDBK-896_17651/)

ASC Manufacturing Development Guide, 8 August 2008

<http://engineering.wpafb.af.mil/mdg/mdg.pdf>

AAC/CC Memorandum, Acquisition Changes to Improve Reliability, Manufacturing, and Safety, 17 March 2008 (Releasability restrictions Unknown. Contact AAC/EN, Eglin AFB, FL 32542)

AFMCI 23-103 – Diminishing Manufacturing Sources and Materiel Shortages (DMSMS) Program, 13 October 2000 (Distribution F. Contact AFMC/ENPM, WPAFB, OH)

DRAFT

## **9.0 PROGRAM RELIABILITY PLAN**

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### **9.1 Introduction**

Problems in the area of reliability continue to get attention at both OSD and SAF. Many weapons systems acquisition programs lack adequate planning to achieve their reliability requirements and do not demonstrate these requirements have either been met or that the system is capable of meeting them once fielded. Addressing reliability early in the systems engineering process is the only way to correct current deficiencies in reliability performance. The development of a robust program reliability plan has been the preferred way to incorporate this into early systems engineering planning. The intent of requiring a program reliability plan with the contractor's proposal is to ensure that their plan aligns with the program office's reliability growth plan and is adequate to achieve its objectives. To ensure that all viable Offerors' program reliability plans conform, clear expectations and minimum standards need to be laid out. The program office must endeavor to establish a criteria that when met ensures that the Offeror will have a high likelihood of meeting all reliability requirements for the system.

### **9.2 Section L**

The Offeror shall propose a Program Reliability Plan that defines how the Offeror will meet the reliability requirements of the program. The plan should detail the time phased activities necessary at all levels of the supply chain to model, grow, and maintain the required reliability, as well as the activities necessary to demonstrate that the required reliability has been achieved. Elements to be addressed in the Plan include, but are not limited to:

**9.2.1** Characterization and understanding of the environments that the system will operate and be stored in, to include methods for actual measurement of environmental data that the system and subsystem/components will be subjected.

For air launched munitions, it is critical to characterize the environments on both threshold and objective aircraft platforms if at all possible. Many weapons have had to undergo expensive redesigns when integrating on objective platforms because of unexpected environmental issues.

**9.2.2** Modeling of the system to establish a reliability allocation for each subsystem and to estimate, at least initially, the total system reliability, and to identify where improvements are necessary.

**9.2.3** Analyses of the system design to identify potential failure modes in order to eliminate or mitigate their probability of occurring.

**9.2.4** Analysis of materials, components and processes to assure compatibility with long-term storage requirements.

**9.2.5** The use of integrated diagnostics (such as Built-in-Test (BIT)).

For munitions programs, Built-in-Test Requirements should be written to cover as many failure modes as possible, since a BIT failure on the ground or in captive carriage is always preferable to a free flight failure.

**9.2.6** A complete and integrated test strategy and plan that provides for the verification of design margins and reliability growth for the system and its subsystems, against the specified/measured environments, use profile, and variations in as-built configurations. The plan should define how the Offeror intends to define and control the configuration of test assets to ensure that such testing is relevant to the final production configuration.

Design margin testing is especially critical on those subsystems with failure modes that cannot be detected by BIT. This usually includes items such as electro-explosive devices, actuators, and fuzes.

**9.2.7** The use of reliability testing techniques to uncover design and manufacturing defects that may cause failures during operation and long term storage.

**9.2.8** Testing at the system level in an operational environment that allows for failure discovery at the all up system level, and that results in acceptable overall pass/fail test results with sufficient enough test assets to support a low rate production decision.

**9.2.9** Demonstration (versus prediction) that the required operational reliability has been achieved within required confidence bounds using a sufficient sample size of production representative items.

**9.2.10** The implementation of in-process testing, stress screening, and life testing to ensure that the reliability of the production system configuration as demonstrated by testing is maintained throughout production.

**9.2.11** The implementation of production lot acceptance testing at system/subsystem levels that balances acceptance test costs with risk to buyer of accepting defective systems or rejecting acceptable systems.

**9.2.12** A formal Failure Reporting, Analysis, and Corrective Action System (FRACAS) for the tracking of failure data, identification of the root causes of all failures and implementation of effective corrective actions.

A corrective action should be defined as a change in design, manufacturing process, or inspection to prevent recurrence of a failure mode. Simply repairing a failed unit is not considered an acceptable corrective action.

### **9.3 Section M**

The Program Reliability Plan is satisfied when the Offeror's Proposal demonstrates the identification, planning, scheduling, and resourcing of the activities necessary to model, grow,

maintain, and demonstrate the required reliability of the system. Of importance are the following critical activities that will be evaluated:

**9.3.1** The adequacy of the Offeror's proposed analysis and testing necessary to characterize the storage, transport, carriage, flight, and other environments in which the system is expected to operate in. Included in such activities are the use of Instrumented Measurement Vehicles, Instrumented Warheads, and/or other measurement devices and test articles necessary to characterize the environments in which the system is intended to operate as defined by the Service Use Profile and the System Performance Specification. These activities should be flagged as reliability related tasks in the IMS.

**9.3.2** The adequacy of the Offeror's proposed reliability modeling of the system, and its use during development of the system. Such modeling must be of sufficient fidelity to allocate reliability among the subsystems or components, to establish an initial estimate of reliability of the system, to guide necessary system design trades, and for use in identifying where design improvements are warranted in the design.

**9.3.3** The adequacy of the Offeror's proposed activities to perform Fault Tree Analysis (FTA) and iterative Design Failure Modes Effects and Criticality Analysis (DFMECA) during the system development to guide the design, with the intent of minimizing failure modes and mechanisms and architecting testing of all levels of the configuration. The DFMECA should show no single point subsystem failures which would result in a safety critical failure at the system level. DFMECA results should also be used as an aid in designing system Built-in-Test (BIT).

**9.3.4** The adequacy of the Offeror's proposed analysis of materials, components and processes to assure compatibility with long-term storage requirements.

**9.3.5** The adequacy of the Offeror's approach to the inclusion of integrated diagnostics (Built-in-Test), with minimal decrease in system reliability.

**9.3.6** The adequacy of the Offeror's proposed integrated test strategy and plan that provides for the definition of design margins and reliability growth for the system and its subsystems, against the specified/measured environments, use profile, and derived requirements for design. Of particular importance is the strategy for the definition and use of margins at every level of the configuration, how those margins will be developed, and how the Offeror will ensure that configuration of test assets used to define margins are relevant to the production configuration.

**9.3.7** The adequacy of the Offeror's proposed approach to Reliability Testing used to identify failure modes for elimination during design development for example:

**9.3.7.1** Comprehensive margin and design sensitivity test and analysis and/or

**9.3.7.2** Highly Accelerated Life Testing on components, subsystems, and the complete system to uncover design and manufacturing defects and/or

**9.3.7.3** Accelerated Aging Testing on components, subsystems, and the complete system to evaluate the ability of a system and its components to survive controlled and uncontrolled storage and/or

**9.3.7.4** Functional Ground Testing on components, subsystems, and the complete system and/or

**9.3.8** Testing of the complete system in an operationally representative environment.

**9.3.9** The adequacy of the Offeror's proposed activities to Demonstrate (versus prediction) that the desired level of weapon reliability is being met, and that with sufficient sample size a pass/fail statistic can be generated which establish sufficiently low risk such that the LRIP decision can be made. The Offeror will provide an assessment of their proposed sample size verses confidence level.

**9.3.10** The adequacy of the Offeror's approach to in-process testing and environmental stress screening to discover and eliminate the potential for latent workmanship defects in deliverable systems.

**9.3.11** The adequacy of the Offeror's Production Reliability Acceptance Test Strategy that balances risk to the buyer of inventory defects in purchased systems, with average unit production costs.

**9.3.12** The adequacy of the Offeror's proposed Documented Failure Reporting and Corrective Action System vertically and horizontally integrated throughout the prime contractor as well as the supplier base, with emphasis on timeliness of root cause definition and correction. The government will also assess the Offeror's proposed effort for trend analysis and reporting. The government will also assess the Offeror's "Can Not Duplicate" and "Retest OK" policies.

## **9.4 Statement of Objectives**

The contractor shall develop, maintain, and document a reliability program that ensures reliability is a primary consideration in all program decisions. The contractor shall characterize the environments in which the system will be stored, transported and operated. The contractor shall model the system reliability and allocate reliability requirements to all subsystems. The contractor shall perform a Design Failure Modes, Effects, and Criticality Analysis (DFMECA) of the system. The contractor shall analyze materials, components and processes used in the system to assure compatibility with long term storage requirements. The contractor shall implement Built-in-Test (BIT) in the system to the greatest extent possible. The contractor shall implement a robust test program to discover and correct failure modes at the lowest possible level of assembly, demonstrate reliability at the system level, and maintain and grow reliability after the system transitions to production. The contractor shall implement a Failure Reporting, Analysis, and Corrective Action System (FRACAS) that analyzes every failure mode discovered in subsystem or system level test, determines the root cause of the every failure, and implements effective corrective actions for all failures. The contractor shall support government

meetings on reliability including, but not limited to, Joint Reliability and Maintainability Evaluation Teams (JRMETs), and Deficiency Review Boards (DRBs).

## 9.5 DIDs

[DI-SESS-81613](#) [Reliability and Maintainability Program Plan](#)

The R&M Program Plan should be included as part of the Offeror's proposal package, either as a stand-alone document or as part of the Systems Engineering Management Plan.

[DI-NDTI-81585A](#) [Reliability Test Plan](#)

[DI-TMSS-81586A](#) [Reliability Test Reports](#)

An alternative to these data items is to use generic test plan and report data items covering all aspects of a given test, including reliability.

[DI-ILSS-81495](#) [Failure Mode Effects and Criticality Analysis Report](#)

[DI-SESS-81315A](#) [Failure Analysis and Corrective Action Report](#)

A good alternative to this data item is for the program office to have on line access to the contractor's FRACAS database.

## 9.6 References

AAC/CC Memorandum, Acquisition Changes to Improve Reliability, Manufacturing, and Safety, 17 March 2008 (Releasability restrictions unknown. Contact AAC/EN, Eglin AFB, FL 32542)



## 10.0 ACRONYM LIST

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AAC	Air Armament Center
AAC/CA	Air Armament Center Deputy AFPEO and Executive Director
AAC/CC	Air Armament Center Commander
AAC/EN	Air Armament Center Engineering and Acquisition Excellence Directorate
AAC/ENS	Air Armament Center Systems Engineering Division
AAC/SE	Air Armament Center Systems Safety Office
ACE	Acquisition Excellence Office
AF	Air Force
AFI	Air Force Instruction
AFMC	Air Force Materiel Command
AFMCI	Air Force Materiel Command Instruction
AFPAM	Air Force Pamphlet
AFPD	Air Force Policy Directive
AFPEO	Air Force Program Executive Officer
ASTK	Acquisition Sustainment Tool Kit
AT	Anti-Tamper
ATP	Acceptance Test Procedure, Acceptance Test Plan
BIT	Built-in-Test
CAIV	Cost As Independent Variable
CDR	Critical Design Review
CI	Configuration Item
CM	Configuration Management
C/M/V	Characterization, Maturation, and Verification
COTS	Commercial-Off-The-Shelf
CPI	Critical Program Information
Cpk	Cost of Quality, Process Capabilities
CSA	Configuration Status Accounting
DFA	Design for Assembly
DFM	Design For Manufacturing
DFME&CA	Design Failure Modes, Effects, and Criticality Analysis

DID	Data Item Description
DoD	Department of Defense
DoDD	Department of Defense Directive
DOORS®	Dynamic Object-Oriented Requirements System
DT	Developmental Test
ECP	Engineering Change Proposal
EMD	Engineering and Manufacturing Development
EOD	Explosive Ordnance Disposal
ESOH	Environmental, Safety, and Occupational Health
EVM	Earned Value Management
EVMS	Earned Value Management System
F <sup>3</sup> M	Form, Fit, Function, and Margin
FCA	Functional Configuration Audit
FISTRP	Fuze Initiation System Technical Review Panel
FMECA	Failure Modes and Effects Criticality Analysis
FRACAS	Failure Reporting, Analysis, and Corrective Action System
FTA	Fault Tree Analysis
GFE	Government-Furnished Equipment
GFI	Government-Furnished Information
IAW	In Accordance With
ICD	Interface Control Document
ICMVP	Integrated Characterization, Maturation, and Verification Plan
ICWG	Interface Control Working Group
IM	Insensitive Munitions
IMP	Integrated Master Plan
IMS	Integrated Master Schedule
IPT	Integrated Product Team
IRS	Interface Requirements Specification
ITR	Initial Technical Review
KC	Key Characteristics

KPP	Key Performance Parameters
LCMP	Life Cycle Management Plan
LRIP	Low-Rate Initial Production
MAP	Manufacturing Assembly Plan
MIL-HDBK	Military Handbook
MIL-STD	Military Standard
MOSA	modular open system architecture
MRA	Manufacturing Readiness Assessment
MRL	Manufacturing Readiness Level
NDIA	National Defense Industry Association
NOR	Notice of Revision
OSS&E	Operational Safety Suitability & Effectiveness
OT	Operational Test
PBLI	Product Baseline Index
PCA	Physical Configuration Audit
PDR	Preliminary Design Review
PFMECA	Process Failure Modes and Effects Criticality Analysis
PLB	Programmable Logic Devices
PM	Program Manager
PPP	Program Protection Plan
PRR	Production Readiness Review
QA	Quality Assurance
RDW	Request for Deviation or Waiver
RFP	Request for Proposal
RM	Risk Management
RMP	Risk Management Plan
RR	Risk Reduction
RVM	Requirements Verification Matrix

SAR	Safety Assessment Report
SCMP	Supply Chain Management Plan
SCN	Specification Change Notice
SE	Systems Engineering
SEAM	Systems Engineering Assessment Model
SEIT	Systems Engineering IPT
SEMP	Systems Engineering Management Plan
SEP	Systems Engineering Plan
SOO	Statement of Objectives
SOW	Statement of Work
SPCA	Single Point Criticality Analysis
SPF	Single Point Failure
SRD	Systems Requirements Document
SRR	Systems Requirement Review
SSEPP	Standard Systems Engineering Processes and Practices
SSPP	System Safety Program Plan
SSR	Software Specification Review
SSS	System/Subsystem Specification OR Software Systems Safety
SUP	Supplement
SVP	System Verification Plan
TDP	Technical Data Package
TIM	Technical Interchange Meeting
TPM	Technical Performance Measure
TRL	Technology Readiness Level
TRP	Technical Review Panel
TRR	Test Readiness Review
UID	Unique Identification
WBS	Work Breakdown Structure